Governance of Sustainable Development: A Case Study of the Bamboo Shoot Production Industry in Lin'an, China

by

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Abstract

Since 1978 China has transformed itself from a planned economy to a market economy, which has been accompanied by the shift from state-centric government to the co-existence of hierarchical and multi-nuclei forms of governance. This research argues that there is a gap in the analysis of rural sustainability governance in China in which insufficient attention is given to: (1) how different governance forms, objectives, and goals affect policy implementation to achieve sustainable development; and (2) how the local state re-organises its functions to achieve socio-economic and ecological sustainability during the reform period. To evaluate the effectiveness of the local state to govern for the sustainable development of the bamboo shoot industry, this research integrates insights from ecological modernisation, political ecology, and eco-Marxism. These perspectives allow a more fruitful understanding of the factors that enable and constrain steering approaches, policy design, and implementation in the bamboo shoot industry.

This dissertation explores resource allocation and management in the bamboo shoot industry in Lin'an, China. It critically examines how governance operates at the county level, which is a key level of governance for the delivery and practice of sustainable development programmes and policies. Data was collected through fieldwork in two towns, one in the upland and the other in the lowland, which enabled an exploration of networks linked to supply chains and geographical differences including both physical and social settings. Under market reform, the Central State decentralises economic rights and autonomy to the local state in Lin'an County, which has increased the synergy, interdependency, and partnership between the local state and non-state actors in the bamboo shoot production industry. This emerges as a multi-nuclei form of governance structure to manage bamboo shoot resources, maintain the local state's administrative authority and intervention, and to increase the indirect rule of the local state through new knowledge and technology production.

Declaration and Statements

This work has not been submitted in substance for any other degree and is not concurrently submitted in candidature for any degree.

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This thesis is being submitted in partial fulfilment of the requirements for the degree of PhD.

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This thesis is the result of my own independent investigation and all views expressed are my own, except where otherwise stated. Other sources are acknowledged by explicit references.

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List of Symbols and Abbreviations

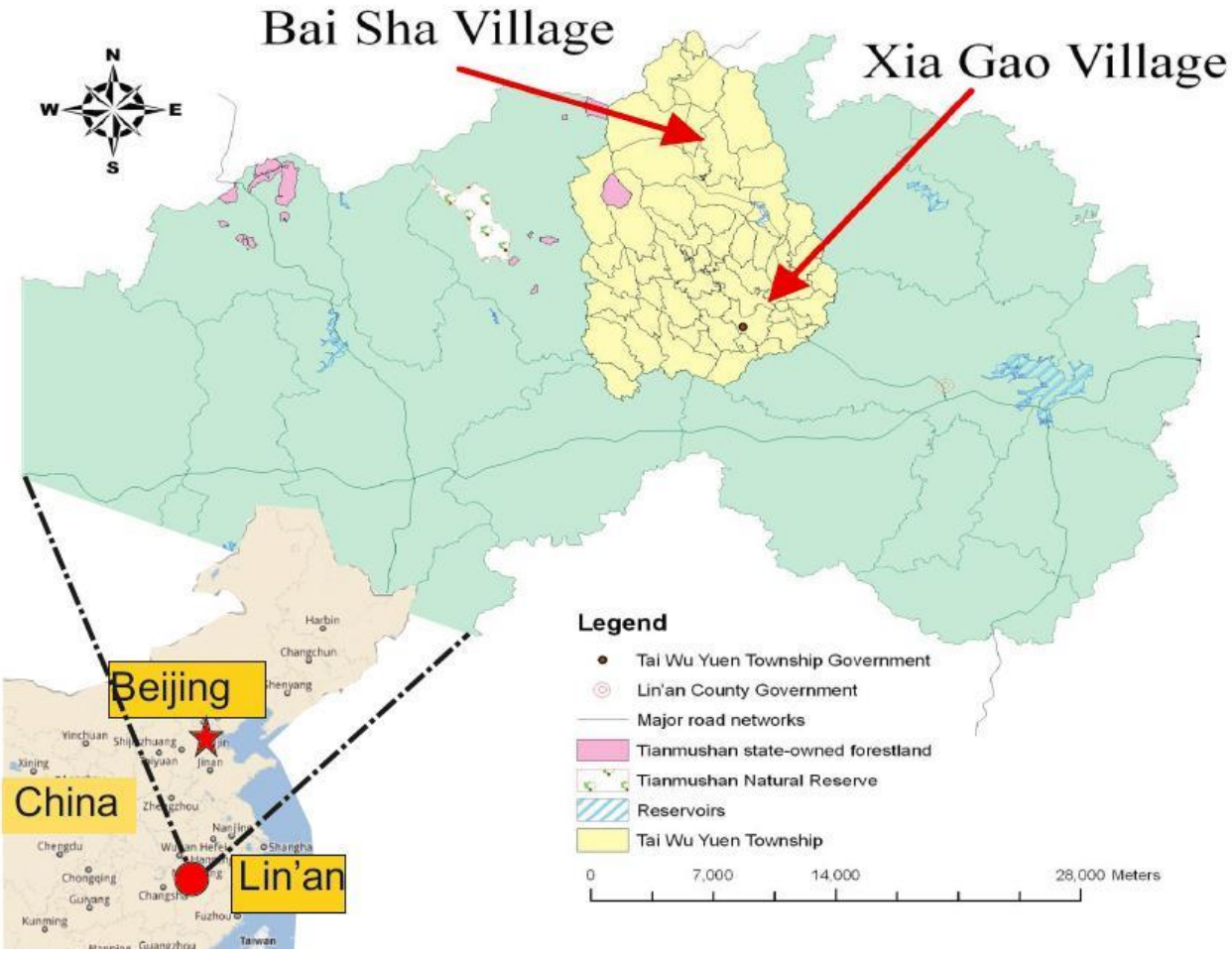
CFRISF	China Forestry Research Institute of Subtropical Forestry
FRS	Forestland Responsibility System
FSC	Forestry Stewardship Council
GDP	Gross Domestic Production
INBAR	International Network Bamboo and Rattan Association
IUCN	International Union for Conservation of Nature
LAG	Land Arbitration Group
LFB	Lin'an Forestry Bureau
LDC	Less Developed Countries
LMTC	Lin'an Modern Technology Centre
NFPP	National Forestry Protection Programme
NTFP	Non-Timber Forest Product
OECD	Organization for Economic Co-operation and Development
SFA	State Forestry Bureau
SLCP	Slope Land Conservation Programme
TVEs	Township Village Enterprises
ZAFU	Zhejiang Agricultural and Forestry University
ZPFD	Zhejiang Provincial Forestry Department

List of Measurement Translation from Chinese to English Metric Units

This research adopts the measurement units including kilograms (kg), hectares (ha), and millilitres (ml). There are three major references made to the Chinese measurement units: (1) “mu,” which is equivalent to 0.15 hectare and (2) “jin,” which is equivalent to 0.5 kilogram (kg); and “dan” is equivalent to 50 kilograms.

Chinese measurement units	European measurement units
1 mu	0.15 hectare (ha)
1 jin	0.5 kilogram (kg)
1 dan	50 kilogram (kg)

The Map of China and Field Sites in Lin'an County



CHAPTER ONE: INTRODUCTION

1.1 Introduction

The traditional vision of China's bamboo forest has evoked a sense of lush, mythic, and spiritual affinities for nature. Chinese people connect with bamboo in everyday practices from using chopsticks, expressing emotions through correlative thinking of bamboo in painting, poetry, and eating bamboo shoots through different culinary recipes. Under China's socio-economic and ecological modernisation, bamboo production and usage have presented a shift in environmental perceptions, resource management, and human-nature relations. The image of bamboo production is not confined to use value, emotion attachment, and culinary practices. Rather, the vision of bamboo usage has been transformed by the contemporary Chinese as multi-purpose, high-value added, and sustainability. However, there is a reverse side to vibrant and high value creations of bamboo production. Overemphasising the increments of scale, speed, and productivity of bamboo shoot production has caused problems of soil degradation, monoculture, and ecological vulnerability in Zhejiang China. This research is going to address these environmental challenges by explaining how a county-level state grapples with land organization, low household income, soil degradation, and disintegration of industry structure to achieve sustainable development.

China's environmental governance is showing a transformation from command-control mechanisms to marketisation through steering private sectors to achieve socio-economic and ecological objectives. The Lin'an state (also referred to as the local state) has re-organised land property, applied technology, institutionalised food production and processing standards, and promoted the integration of the industry in bamboo shoot production. The study of the bamboo

shoot production industry in Lin'an County provides a compelling case study of how the local state tackles two closely linked policy dilemmas: land degradation and economic growth, by using the theoretical lens of environmental governance. Through addressing major actors' perceptions and interactions in the bamboo shoot production industry at the county-level, this study provides theoretical and methodological insights on China's environmental governance from a bottom-up perspective. It integrates both grassroots' voices with a top-down analysis of policy directives from central down to a local county. It combines microanalyses of bamboo plantations' productivities with macro data of land use changes, and triangulates state actors' perceptions with farmers' responses and longitudinal ethnographic observations. This innovative approach not only displays the complexities and multi-faceted dynamics of actors' interactions at the local level but also contributes conceptual insights to the debates among scholars of ecological modernisation, eco-Marxism, and political ecology into how the environment is shaping the development trajectory in China.

The research contributes to the understanding of the local governance of sustainable development in China in three major ways: (1) how the local state combines both direct and indirect policy intervention to create an incubating environment to steer multiple actors to achieve socio-economic and ecological goals; (2) how the local state operates in both unitary institutional and multi-nuclei governing structures through collaborating with farmers' co-operatives, processors' associations, and market sectors; and (3) how state and non-state actors interact to solve the problems of land organisation, low household incomes, soil degradation, and disintegration of the industrial structure to achieve sustainable development.

This chapter is divided into five sections. Following the introduction, section two discusses the debates among ecological modernisation, eco-Marxism, political ecology and its implications for establishing an integrative approach to study the "local governance of sustainable development" in China. Section three elucidates the objectives, significances, and contexts of this research study to contextualise the local dimension of environmental governance through the case study of the bamboo shoot production industry in Lin'an County. Section four presents the structure of the dissertation and key arguments. Section five summarises and concludes this chapter.

1.2 An integrative approach to the study of environmental governance in China

Hitherto, researching sustainable development in China faced a paradox; actions to achieve environmental conservation were dangled with the carrot of market mechanisms and hit with the stick of stricter environmental regulations. The former was achieved through promoting eco-efficiency production processes, which trickled down resources to create a positive feedback loop; the latter focused on legal enactment and enforcement to regulate negative externalities under the pro-growth development processes. Commentators have argued that adopting ecological modernisation as a guiding development principle could help China to institutionalise environmental practices in both economic development and environmental conservation (Carter and Mol, 2006; Economy, 2006). Other researchers have proposed that China takes the de-growth or proportional growth development model to reverse the practices of resource exploitation and environmental degradation under the impacts of market reform (Tilt, 2010; Shapiro, 2012). The tension between the pro-growth and de-growth arguments show the continued need to question whether China can maintain both environmental and economic sustainability in the long-term. To

provide answers to this question, one approach is to explore “the governance of sustainable development” and this has become a research priority among ecological modernists, eco-Marxists, and political ecologists. Their debates provide insights into the role of state and market, the centrality of human and nature, and the approaches of pro-growth and de-growth to achieve sustainability governance in China. This research aims at integrating the empirical and methodological insights from ecological modernisation, eco-Marxism and political ecology to theorise the local “governance of sustainable development in China.” This local dimension focuses on theorising how a county-scale state tackles policy dilemma between economic growth and environmental conservation with multiple actors in county, township, and village levels. Norton (2005) argues that current environmental governance debates are full of confusion due to different discursive expressions and incompatibilities of theoretical traditions. To tackle this theoretical challenge, Davidson and Frickel (2004, pp.476-473) point out that current theories in environmental governance are “theoretically overlapping” and not necessarily “mutually exclusive or contending”. Instead, the major differences lie in the theoretical traditions, research questions, and methodology adopted by researchers. This research will take Davidson and Frickel’s argument further by integrating the debates among ecological modernisation, eco-Marxism, and political ecology in environmental governance to address; (1) China’s complex and dynamic ecological challenges at the local level and (2) illustrate how these approaches play complementary roles to elucidate China’s local environmental governance politically, socially, and ecologically. Therefore, this research is not going to stress the philosophical differences among these approaches. Rather, more research effort emphasises the greater level of incorporation in their empirical and methodological insights. Particularly, integrating the debates among ecological modernisation, eco-Marxism, and political ecology will help this research to understand the co-existence between a strong Chinese state and market mechanisms, the capacities among state and non-state actors to produce

knowledge, and diffuse technology to make use of bamboo shoot resources to achieve sustainable development.

To address China's local governance of sustainable development, the debates among ecological modernisation, eco-Marxism, and political ecology are a relevant theoretical lens because these help to unravel the policy dilemma between economic growth and environmental conservation, critically reflecting the role and capacity of the state to grapple with ecological risks and challenges, and unravels the causes and effects of environmental transitions. The bamboo shoot production industry in Lin'an County provides an insightful case study to illustrate these debates in five major facets.

1.2.1 Scale of analysis in environmental governance

There are different scales of analysis for the governance of sustainable development in China, cutting across societal, institutional, and individual levels. Ecological modernisation stresses the meso or macro-scale understanding of the institutional transition, jurisdiction innovation, and the decentralisation process of China's environmental governance (Economy, 2006; Ma and Ortolano, 2000). The ecological modernists stress the institutional analysis of China's environmental policies and project delegations from central to local state. The strength of this approach is to provide a fruitful understanding of formal environmental governance structures by illustrating how China's governance structure evolved from centralisation to decentralisation and from command-and-control to increasing flexibilities through marketisation and privatisation during market reform. However, the challenge of this approach is an over dependence on the state's statistics and documents to examine environmental policies' formation, with an over-simplified approach that typifies power as cascading down hierarchies alongside the market mechanism. By way of contrast, eco-

Marxism and political ecology adopt a multi-scalar analysis of China's environmental governance. Eco-Marxists employ dialectical reasoning to question different patterns and degrees of power relationships in a multi-scalar manner. Eco-Marxism combines both micro-and macro-scales of analysing how the dominant class manipulates nature and creates asymmetrical social relationships in specific institutional settings in network forms (Bulkeley, 2005; Castree, 2002; Rocheleau and Roth, 2007; Smith, 1996; Swyngedouw, 2008). The scope of political ecology not only addresses different levels of environmental politics on vulnerable biotic and abiotic milieus, but also adopts a network synthesis of actors' interactions in a hybrid governance setting (Grove, 2009; Swyngedouw and Heynen, 2003; Zimmerer and Bassett, 2003). Political ecologists' approaches also are different from ecological modernist' researchers on institutional behaviours and government officials' visions. They combine political economy approaches with ecological studies to research opaque actors such as ethnic minorities and yield more societal research on power and discourses, environmental justice, and ethnic minorities in China (Bryant and Bailey, 1997; Fairhead and Leach, 1995; Robbins and Sharp, 2003; Swyngedouw 2008, Tilt, 2009; Wainwright, 2013; Yeh, 2009). Both eco-Marxism and political ecology go beyond institutional boundaries to conduct more research on vulnerabilities and risks to marginalised groups, across networks of individuals, in a bottom-up fashion. Their approach provides two major insights for this research to consider China's local governance of sustainable development: (1) the role of environmental state is not a unitary and static body. Rather, China's environmental policies, decisions and implementations are produced, evolved and contested through polycentric governing settings; and (2) combining both institutional analysis with network synthesis of state and non-state actors' interactions provide a more holistic picture of China's environmental governance (Adger et al., 2003; Bulkeley, 2005). Therefore, this research calls for theorising of China's environmental governance by integrating both state

actors' perceptions, farmers' voices and combining both statistical data with micro ethnographic analyses in a specific spatial and temporal context.

1.2.2 Compatibilities between economic growth and conservation

Research on the role of the Chinese state in the governance of sustainable development is a crucial research agenda among ecological modernists, eco-Marxists, and political ecologists because of its contradictory role of maintaining both economic growth and environmental protection. Regarding the debates on the compatibility between economic development and conservation, Ecological modernists believe that economic development in China is compatible with environmental conservation through market signals, quotas, tradable emission permits, and economic innovations to achieve sustainable development (Economy, 2006; Rock, 2002). Therefore, ecological modernists support the marketisation and privatisation of the Chinese state in order to establish pricing systems to allocate and prioritise natural resources (Mol et al*.,* 2009). However, eco-Marxists do not agree with the compatibilities between economic development and conservation because capital accumulation occurs through increasing productivity and reducing costs of production. Under this logic, the Chinese state and market will transform nature through exploitation and commodification to maintain economic growth. Political ecologists are more neutral on the compatibility between economic development and environmental conservation. However, they pay attention to the "politics' in the policy process and "outcome" of the environmental changes by looking at marginality, vulnerability, and risks to the marginalized groups in everyday and episodic bases (Bryant and Bailey, 1997, p.30). Moving beyond the impasse in theoretical debates among ecological modernists, eco-Marxists, and political ecologists, this research considers whether the pro-growth bamboo shoot production system is compatible with the notion of preserving the natural environment in Lin'an County.

Ecological modernists, eco-Marxists, and political ecologists apply different values on the role of the state in protecting nature. Ecological modernisation stresses the role of state and market as resource allocators to create an eco-production model to trickle-down resources and solve environmental problems (Buttel, 2001; Spaargaren & Mol, 1992). However, eco-Marxists argue that a strong state should be maintained to allocate natural resources in an egalitarian way (Harvey, 1996). Political ecologists also pay attention to the development of an egalitarian government to redistribute resources to protect the interests of marginalised groups and vulnerable natures. These perspectives have different levels of anthropocentricity: ecological modernisation shows a stronger anthropocentricity because it stresses the potential of technological fixes and institutional approaches to tackle environmental problems; while eco-Marxism tends to embrace dialectical, metabolism and fluidity when considering human-nature relationships (Benton, 1989; Castree, 2002; Sheppard, 2008), which show weaker anthropocentricity. In the early stage of theoretical development, political ecologists were critiqued as neglecting the role of nature (Walker, 2006). However, recent theoretical development goes beyond this impasse by engaging with sustainability science, multidisciplinary approaches, and post-structuralist theories to examine environmental problems (Bennett, 2009; Li, 2007). Political ecology shows the weakest anthropocentricity by emphasising the co-functions of heterogeneous human and non-human actors to co-produce sustainability. The discussions among these three perspectives provide questions for this research to consider such as how local state and non-state actors perceive, value and make use of bamboo shoot resources to produce economic value and rejuvenate ecological degradation (see Chapter Four).

1.2.3 Perceptions of technology and environmental limits

Concerning the perceptions of technology and environmental limits, eco-Marxists are sceptical of a technological-fix to solve China's environmental problems and the presence of ecological scarcity in the social system. Eco-Marxists believe that there is a contradiction between capital accumulation and environmental conservation because the dominant class adopts new technology to overcome underproduction and maintain capital accumulation. According to O'Connor (1998) whether in economic boom or crisis, more technological advancement means more resource exploitation and waste. Harvey (1996) critiques the Malthusian ideology of environmental limits by arguing that "eco-scarcity" is socially constructed; pollution and resource allocation are organised as the outcome of a specific structure of social articulation. Meanwhile, ecological modernists argue that technological advancement, with careful consideration of the distribution of negative externalities, can increase Chinese environmental capability to solve environmental problems (Mol et al*.,* 2009). Ecological modernists decline to accept the "limit to growth" discourse because technological advancement and innovative knowledge can be applied in utilising resources, recycling materials, and redeveloping dynamic relationships among social actors in different production and consumption cycles (Mol and Spaargaren, 2009). Finally, political ecologists are more neutral on technology advancement because the latest development of this field is to engage with traditional sciences, material ecologies, and complexity theories to look for practical solutions and ponder alternatives (Blaikie 2008; Rocheleau, 2008). Political ecologists call for a combination of both structural and post-structural perspectives in order to examine the biophysical and bio-economical changes in China by exploring the co-functions of human-nature-technology in two major ways; (1) analysis of human-nature-technology relationships by considering the potential and vibrancy of using nature as a socio-ecological fix such as carbon

sequestration technology (Yiping et al., 2010) and (2) adopting fluid thinking to re-organise ecology, and reconsider the co-functions of non-human actors in environmental management (Anderson et al*.,* 2012; Bear 2012; Li, 2007). Political ecology perspectives go beyond the adaptation and mitigation approaches that are dominating much thinking in Chinese environmental debates by proposing a new mode of theorizing environmental changes with the concepts of scales and linkages, technical and co-constitutive logics to reflect human-nature relationships. Political ecologists recognize environmental limits; however, they are more positive about identifying the in-between processes of nature and technology, innovations and instruments to search for socio-ecological solutions to achieve environmental sustainability in China. The tensions among ecological modernisation, eco-Marxism, and political ecology's arguments provide unanswered questions for this research to consider whether technological extension and knowledge production in the bamboo shoot production system in Lin'an County can (1) reduce environmental impacts and (2) be aware of the limits of the ecosystem (see Chapter Six).

1.2.4 Structures and roles of actors in environmental governance

To address China's governance structures to implement the policies of sustainable development, ecological modernists seek to provide understanding of China's institutionalised environmental practices and policies during the reform period. From an ecological modernisation perspective, there is a focus on knowledge about the institutional factors, which facilitate the institutionalisation of new governing bodies, environmental policies, and jurisdictions along different administrative levels in China's environmental institutions; for instance, the development of the State Environmental Protection Agency (SEPA), the implementation of cleaner production measurements in industrial production and the enactment of pollution control regulations. Ecological modernists emphasise

how environmental practices become institutionalised over a period of time. For instance, Lo and Tang (2006) examine how a new environmental quality administrative leadership responsibility system has been implemented in the Guangdong Province as part of institutional reform in China. However, eco-Marxists point to institutional constraints that "limit" the institutionalisation of environmental practices. For instance, eco-Marxists express concern about the implementation deficit, system bias and informalities of institutional systems. For instance, Yeh (2009) explores those structural constraints which cause social inequity, inequality, and hindrance to indigenous people to access natural resources in the Chinese Tibetan plateau. Wainwright et al*.,* (2012) elucidate Chinese villagers' subordinate positions in relation to local state interests and employment opportunities from polluted industrial plants that produces a sense of inevitability for villagers who have to live with pollution. Political ecologists expose development defects, which "hinder" non-state actors participating in governing processes. Political ecologists are interested in the voices and opinions of "opaque" actors in the development process, such as farmers and ethnic minorities, and to work to make sure that their views are addressed. For example, Tilt (2007) examines the processes and consequences of pollution enforcement in ethnic minorities in a township in Sichuan. Hershkovitz (1993) meanwhile theorizes a local environmental management approach in the Loess Plateau in China, by researching farmer household practices. Although ecological modernists, eco-Marxists and political ecologists embrace the understanding of the interactions between the role of state and non-state actors in China's governance of sustainable development, ecological modernists stress the value of research on the environmental practices of state and market actors with respect to China's political and ecological modernisation (Economy, 2006). Meanwhile, eco-Marxists and political ecologists emphasise the practices of non-state actors especially farmers, workers and ethnic minorities. Their debates shed light on this research in two major ways: (1) it helps this research to

consider how the local bamboo shoot governance structure responds to the Central State policies as they cascade down to the local state and how local state actors make plans and mobilise farmers to execute the Central State's projects (see Chapter Five); and (2) it helps this research to ask questions about the role that state and non-state actors play in the institutionalisation of sustainability practices (e.g. the standards of bamboo shoot production, processing, quality assurance system), and embedded norms and values (i.e. trust-making, gift-exchange politics and negotiations) in the bamboo shoot production system in Lin'an County to achieve sustainable development (see Chapters Six and Seven).

1.2.4 Trajectory to achieve sustainable development

The trajectory of Chinese sustainable development is uncertain, unpredictable, and full of complexities; this research explores the meanings of Chinese sustainable development pathways from within China's local context. There are three major points for this research to stress before searching for sustainable development options. First, the pro-growth mentality is still dominant in Central State policies. Under pro-growth market reform, the Central State restructured to move the economy from centralisation to decentralisation (Carter and Mol, 2007). For decentralising economic development, the Central State ambitiously encouraged local states to attract foreign direct investment (FDI) from overseas Chinese to establish growth-poles in the coastal areas (e.g. Special Economic Zones). It stressed export-led development to trickle down economic resources to transform local economies, privatisation of state-owned enterprises, and decentralisation of fiscal autonomy to lower levels of government (Bao et al*.,* 2002; Cartier, 2001; Naughton, 1994; Oi, 1995).

Second, the local state plays a strong role in regional development. There is recognition that the power of a local state can be wielded for good and ill toward the natural environment. Local states typically develop an incubating environment for industrialisation to attract foreign direct investment (FDI), to develop the township-village enterprises (TVEs) and commercialisation of agricultural production to propel rural development. Local states utilised the rights for fiscal autonomy to make profits from industrialisation and agricultural production to maximize extra revenue for local government expenses and tax retention, particularly in the county and township levels of governments (Lin 2009; Oi 1992 and 1999). This fervent desire to maximise revenues became the local state's incentive to prioritise economic development before environmental conservation (Chan 1995; Tang et al*.,* 1997). Although there are numerous cases that describe and reflect the environmental challenges in China, these are not sufficient to help the environmental victims to voice their needs from the ground. There are two major reasons why the opinions of local resource users are ignored: numerous environmental studies in China highlight institutional analysis of the policy mechanisms (Economy, 2006; Ma and Ortolano, 2000) and a historical dimension to understand environmental state's values (Bao, 2004; Elvin, 2008; Edmonds, 2012). However, there are lacunae in literature and approach to incorporate state policies with farmers' voices to understand the policy dilemma between economic growth and environmental conservation at the local state level.

Third, China's economic and ecological modernisation is an unfinished social process. It is difficult for China to situate her roles between economic development and environmental conservation; on the one hand, China has to maintain its robust stage of economic development with an average of 9.5 % economic growth rate annually since 1978 (OECD, 2005) to trickle down resources and propel social development. On the other hand, the social and

environmental cost of economic development has reached an alarming rate; the Central State should take remedial measures to solve pressing environmental problems (Hsing, 2012; Solinger, 2006; Shapiro 2012; Yeh, 2009). Particularly, rapid economic development has accelerated China's resource exploitation, deforestation, and environmental degradation in different parts of China (Jiang, 1999; Ma and Ortolano, 2000; Shapiro, 2001; Cook and Murry, 2003; Smil, 1993). For instance, in early 2014, hazardous smog engulfed most of the northern Chinese cities. Approximately 80 % of China's rivers became polluted and around 90 % of the urban water was severely contaminated and hazardous to human health (Chen, 2007). The expanding economy and the rise of the middle class increased the resource exploitation, waste productions, and food consumption (Shapiro, 2012). State Council data indicated that "90% of China's grasslands is [were] degraded, and that the degradation is [was] increasing at a rate of 200 km^2 per year" (Yeh, 2009, p. 890). Approximately 130 million hectares of grasslands are now degraded and have lost their vegetative cover, and this area is expanding at an annual rate of 2 million hectares (Li, 2006). Forest exploitation not only became one of China's most pressing environmental problems but also drew global attention in the 21st Century. A large number of articles and books began to appear and highlight the concerns over China's forest depletion (Hyde et al*.,* 2003; Xu and Ribot, 2004; Grosjean and Kontoleon, 2009; Wang and Maclaren, 2012).

The above context illustrates how China encounters the policy dilemma between economic growth and environmental degradation, the theoretical lens of ecological modernisation, and eco-Marxism and political ecology provide insightful directions for China to consider environmental policies holistically. First, ecological modernists should provide reflexive thinking and rationalities for Chinese policy makers to use new technology, institutionalise environmental practices, adopt market instruments (i.e. tax and subsidies), and reorganise

institutional arrangements to increase the capacities of the state to maintain economic growth and tackle environmental risks.

Second, eco-Marxists should provide a dialectical schema, which is an environmental thought to illustrate human perceptions on nature in specific historical material practices. This thinking helps Chinese policy makers in two major ways: (1) to consider class oppositions and gender suppression, (2) to avoid viewing nature as a purely “instrumental” relationship by embracing the idea of heterogeneities, differences, diversities, collective emancipations, and different modalities of transformations in devising environmental policies (Harvey, 1996). Eco-Marxists suggest policy makers pay attention to informalities, system biases, and the destructive nature of capitalism. Maintaining a strong role for the state to redistribute resources and maintain social justice is the way to develop a sustainable form of social development.

Third, political ecologists contribute relational thinking of co-functionality, multi-scalar and relational schema for Chinese policy makers to realize how politics marginalizes subordinated groups, increasing environmental vulnerabilities, and accelerating ecological risks in China (Yeh, 2009). Additionally, relational thinking in political ecologists’ approaches help policy makers to consider the role and capacity of non-human actors (e.g. animals and nature) to mitigate environmental problems (Yeh and Lama, 2013; Robins and Marks 2010). For instance, to consider the potential and vibrant roles of bamboo to fix environment problems, including wood substitution and reduced logging, and increased carbon sequestration.

1.3 Research objectives, significances, and contexts

Through the theoretical lens of ecological modernisation, eco-Marxism, and political ecology, this research aims to examine how the role and capacity of local state grapples with the dilemma of economic development and environmental conservation to achieve sustainable development. The Lin'an bamboo shoot production industry provides an insightful case study to achieve three major objectives:

1. To critically address how state and non-state actors govern the bamboo shoot production industry in Lin'an.

2. To analyse the co-existence of both state-centred and multi-nuclei governance structures to promote sustainable development policies in the bamboo shoot production industry.

3. To critically evaluate the role of the local state in Lin'an in tackling the tension between a) environmental conservation by exploring soil degradation and b) economic growth through the re-organisation of the bamboo shoot industry to increase efficiency.

To achieve the first objective, this research identifies how state and non-state actors' re-organise land property, cultivate bamboo shoots to rejuvenate degraded lands in the mountainside, decentralise the rights of making economic decisions, and deliver and implement policies. From bamboo shoot policies' and programmes' analyses, this research can understand how the role and responsibilities of state and non-state actors work to distribute land property, manage bamboo resources, and solve environmental challenges (see Chapter Four). To achieve the second objective, this research unravels the bamboo shoot

governance structure under the combination of state-centred and multi-nuclei governing structures through establishing new institutions, stipulating policies and projects whilst collaborating with farmers and universities to solve soil degradation and standardisation problems (see Chapter Five). To achieve the third objective, this research explores the ways in which state and non-state actors collaborate to maintain economic growth and solve soil degradation problems through: spatial specialisation, institutionalisation of food production, and processing standards, price signals and market establishment (see Chapters Six and Seven).

1.3.1 Significance of this research

Integrating the analytical and empirical strengths of these theoretical strands allows this research to theorise the local dimension of "governance of sustainable development". This framework contributes to theoretical foundations and provides new empirical understandings of China's environmental governance in three major ways:

First, this research demonstrates how to combine macro data with microanalysis of non-state actors' interactions, and to triangulate government policy documents with farmers' comments. This innovative approach is highly applicable for ecological modernists because it helps them to strengthen the bottom-up views about institutionalisation of environmental practices at the grassroots' levels and evaluation of the participation of non-state actors in the governing process.

Second, this research elucidates how local state and non-state actors attempt to promote bamboo shoot production technologies and knowledge to reduce soil degradation and increase production standards. The perception of

technology utilisation to solve environmental problems may not be as negative as eco-Marxists' believe. Rather, this research shows the ways, rationalities, and potentials of how to use technology are far more important for eco-Marxists to consider.

Third, political ecologists can take one step further by engaging with post-structural thinking to open up more discussions on the co-functionality of human-nature-technology relationships to tackle China's environmental challenges. The bio-technological capacities of bamboo resources provide a research agenda for political ecologists to consider in-between capacities between bamboo nature and technology, innovations and instruments to search for socio-ecological solutions to solve environmental problems.

Fourth, building a "local dimension" in the governance of sustainable development provides better solutions to align private interests, political realities, and the natural environment at the local level to take collective actions to achieve sustainable development in specific geographical and temporal contexts. This paradigm enables state and non-state actors to speak and share their experiences in environmental changes and allows this research to contextualise the key decision makers, steering approaches, policy design, and implementation of actors' interactions in the bamboo shoot production industry.

1.3.2 Research contexts

The analytical logic of this study is based on the temporal and structural analysis of the institutional transformation of the local state in three major time periods: (1) communal period (1958-1978); (2) early market reform period (1978-2001); and (3) market reform period which is characterised by re-collectivisation and the increase of state's indirect rule (2001-2014). The delineation of these three periods is based on the collectivisation and de-collectivisation of land ownership, means of production, and policy evolution. The transformation of local governance is a continuous and dynamic process, which encounters tensions between economic growth and environmental degradation. An integrative theoretical approach is devised to understand this dynamic through (1) conceptualising the local dimension of the governance in relation to the sustainability policy implementation, co-ordination and steering approach between the state and non-state actors (extended discussion in Chapter Two); (2) examining how the co-existence of state-centric and multi-nuclei governing structures co-produce sustainable policies and programmes in the bamboo shoot production industry.

Since 1978 Deng Xiao Ping's incremental reform trajectory ("touching stone to cross the river"), China has transformed from Socialism to a socialist market economy (Nolan, 1994). The former was characterised by centralised economic planning, proletariat dictatorship, and communal ownership of agro-forestry resources. The latter focused on perpetuating one party rule and state interference in economic reform, which has emerged as a co-existence of state-centric and multi-nuclei forms of governance. These multi-nuclei forms of governance mean the local state collaborates with research institutions, farmers' co-operatives, bamboo shoot processors' association and bamboo shoot market to influence farmers to grow bamboo shoots in order to tackle both socio-

economic and environmental problems in the market reform period. This state-centric and multi-nuclei form of governance has two major features: first, the Central State maintains nation-wide economic planning and top-down co-ordination from the central to county and township level of government. Second, the Central State decentralises fiscal autonomy to lower levels of government and de-collectivise communal resources through the implementation of the Household Responsibility System (extended discussion in Chapter Two).

Therefore, analysis starts from examining the de-collectivised communal lands and resources after the market reform. This is because land de-collectivisation is the first step to releasing labour force and increasing individual economic incentives. In so doing, this research examines how the Lin'an state implemented the Forestland Responsibility System (FRS) to de-collectivise the means of production and communal lands to individual farmers and increased farmers' incentive to grow economic crops and maximize their economic revenues (extended discussion in Chapter Four).

The second analytical step focuses on how a state-centric institutional framework transformed into a co-existence of state-centric and multi-nuclei form of governance (extended discussion in Chapter Five). By examining the steering approach, decision-making, and resource allocation before and after the market reform period, this research unravels how a local state responded to both top-down steering and horizontal policy co-ordination during market reform. Since 1982, the Lin'an state has actively influenced and guided farmers to grow bamboo shoots to achieve the Central State's greening directives, grapple with low household income, and solve soil erosion problem.

Owing to the problem of small landholdings and low productivity of forestland, this drove the Lin'an state to promote "early-shooting technology" to manipulate the shooting period of bamboo shoots to match market demand. Therefore, the third step of the analysis stresses how the decentralisation of communal lands in 1982 has caused the problem of small landholding and low forestland productivity during the early reform period. In particular, it is important to understand how the local state co-ordinated with research institutions, the Forestry Bureau, and demonstration households to promote early-shooting technology to tackle the limit of carrying capacity in small forestlands.

Although the local state was successful in promoting early shooting technology and boosted the productivity of bamboo shoot production, this produced two major problems: (1) over-supply of bamboo shoots which led to low market prices and (2) over-using fertilisers which caused soil degradation. To solve these problems, in the late 1990s the local state developed the processing industry and marketing sector to absorb overproduction. Therefore, the fourth step of analysis emphasised how the local state developed the processing and market sectors to utilise those over-produced bamboo shoots. During the 2000s, the local state put more financial and human resources into solving soil degradation problems by institutionalising production and processing standards and educating farmers to adopt cleaner production methods. Therefore, the fifth step of the analysis is to understand how the local state co-ordinated with the research institutions, demonstration households, processors, and farmers' co-operative to implement the production and processing standards.

To better understand the institutional transformation of the local state during the market reform period, this research considers the appropriate scale to analyse both top-down policy delegation and bottom-up policy implementation in the China's institutional system.

1.3.3. Scale of analysis

China's institutional system operates in both vertical hierarchical and horizontal networks of state and non-state actors at the central, provincial, county, township, and village levels. Under the province system, there are three major levels of administrative network of governing institutions: (1) prefecture-level governments, (2) county and city level governments (see Figure 1) and (3) township and district-level governments (see Figure 2). The government and the party organisations (Community Party of China) are paralleled in these three levels of governments below the Central State (provinces, county and township) (Saich, 2001, p.142).

This research focuses on the administrative level below the county level in one of the most important bamboo shoot production region in Zhejiang Province. The province is the sub-national administration in the Chinese system (Saich, 2001, p.143). The Zhejiang province is the largest bamboo production area located in the Eastern part of China, adjacent to the city of Shanghai. The administrative hierarchy of Zhejiang province is apportioned into 11 prefecture-level cities, 32 districts, 22 county-level cities, and 35 Counties (see Figure 1).

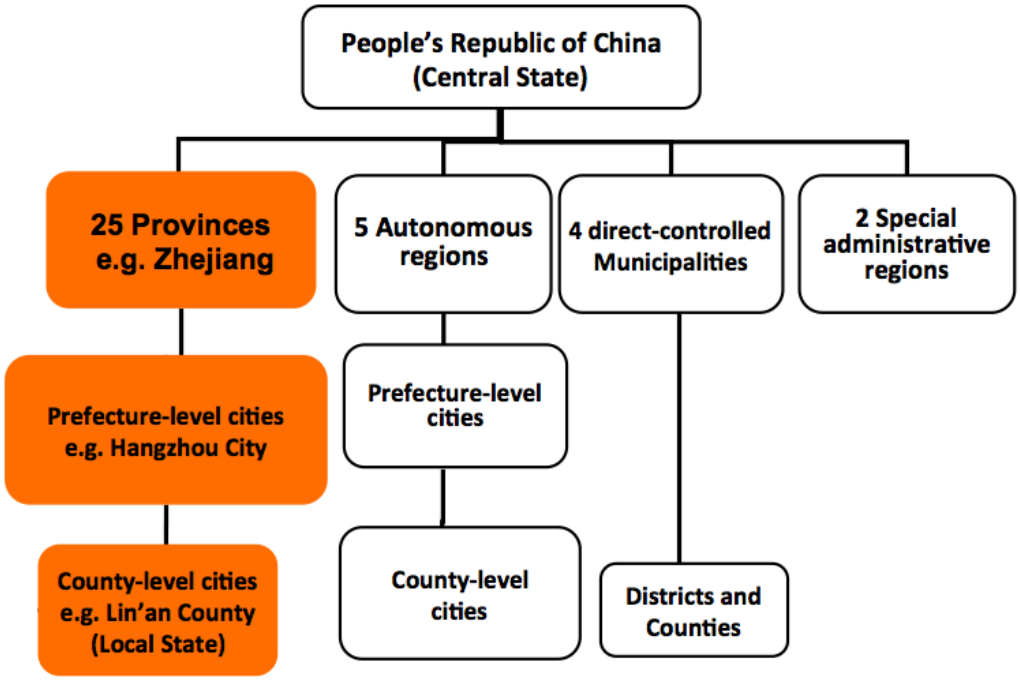


Figure 1 Administration Levels in China

In Lin'an County, this research stresses how vertical administration operates from county level government to the village level rural committee in the bamboo shoot production system (see Figure 2). By so doing, the research focuses on Central State's forestry policies operated at the county level: specifically, how the roles and responsibilities of county government collaborates with township and village level governments to design and implement bamboo shoot policies along these three levels of administration (County-township-village).

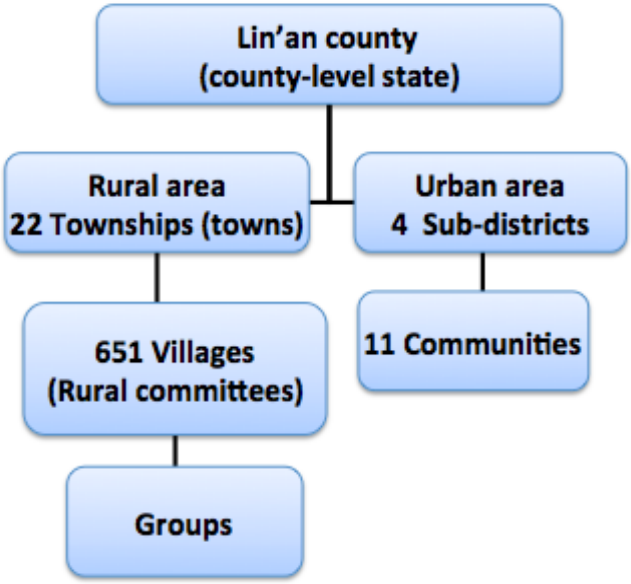


Figure 2 Administrative Levels in Lin'an County

This study selected Lin'an County in Zhejiang province as the case study location because county scale is the implementation level of the Central State's forestry policies. The policy environment of the Lin'an County towards land reform, forest afforestation, institutionalisation of food production and processing standards, and industry integration operates in both top-down hierarchical and horizontal actors' interactions (see Figure 3).

This research argues that traditional central planning co-exists with marketisation through steering multiple actors to resolve the conflicts between economic growth and environmental conservation (see Figure 3). The Central State employs political power and legal forces to deliver policy directions and commands from central down to local state. In comparison to the Mao regime, the Central State utilises both direct and indirect modes of governance (Lee et al., 2012); however, the local state has an increased role in making decisions,

implementing policies, and co-ordinating multiple actors (see Figure 3). During the market reform period, there was a shifting of roles and power between central and local state in dealing with county-level issues; local state has the autonomy in how to devise specific projects and implementation, interpret and negotiate in its own methods to achieve Central State's directives. Decentralisation of policies and economic rights drives the local state to collaborate with non-state actors at the county level in order to increase administrative efficiency and reduce administrative cost. The local state collaborates with local institutions (e.g. farmers' co-operative, universities, industry's association and demonstration households) to implement forestry policies, utilise bamboo shoot resources, and institutionalise food production and processing standards. The collaboration and interaction between state and non-state actors construct a co-existence form of state-centric and multi-nuclei form of governance (see Figure 3).

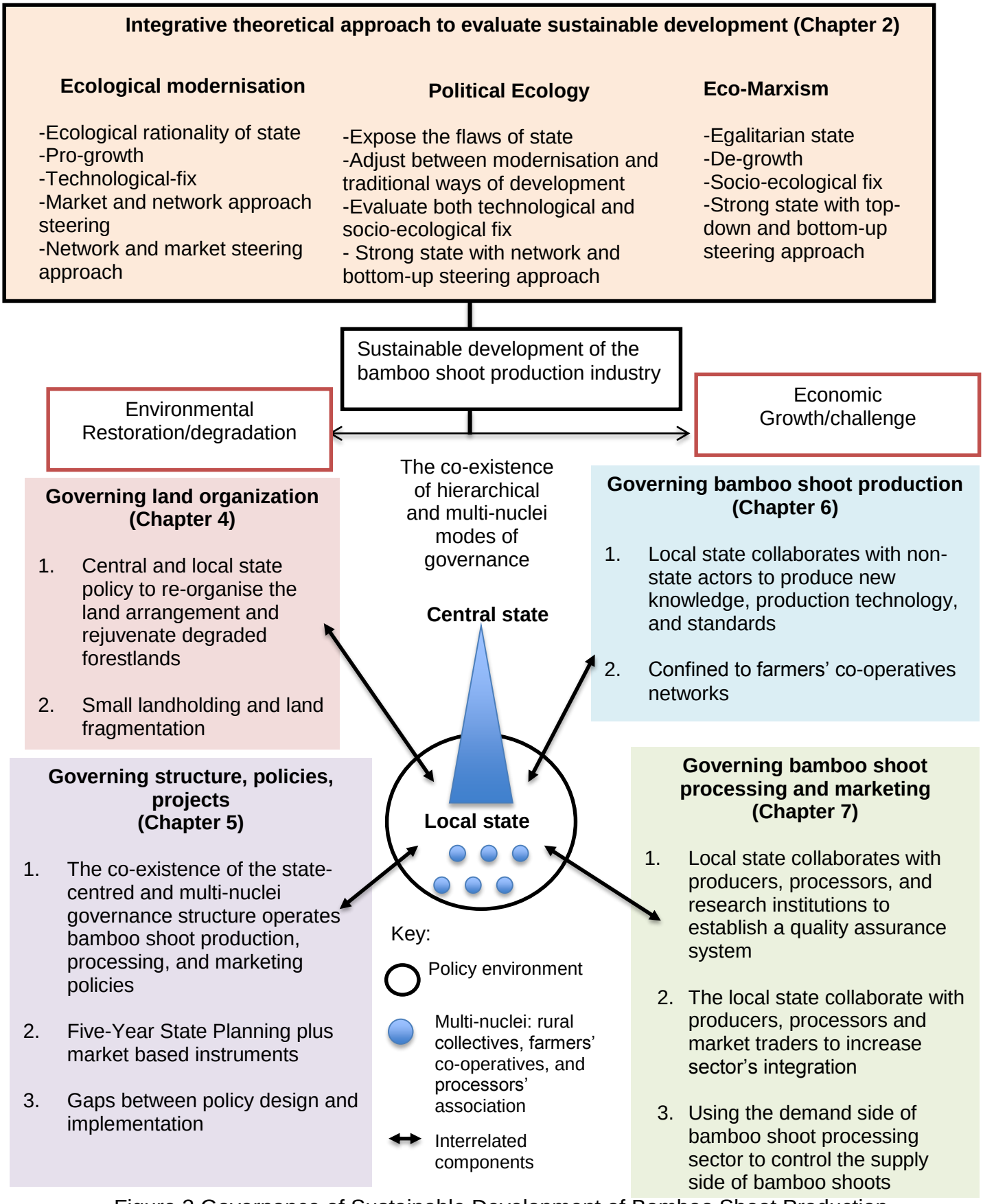


Figure 3 Governance of Sustainable Development of Bamboo Shoot Production

In the past 30 years, the bamboo shoot production industry in Lin'an has entered its most robust stages of development. However, the environmental cost of rapid development has produced soil degradation and economic risk, which directly affected the economic interests of bamboo shoot farmers. To fix the soil degradation problem, the local state promotes soil restoration technology to ameliorate environmental degradation; in addition, the local state institutionalised hazard-free production standards (cleaner production practice) to maintain the economic growth of the bamboo shoot production industry. The socio-economic context of Lin'an County demonstrates a dynamic and contradictory development trajectory between maintaining economic growth and environmental conservation. There are two major ways to frame this dynamic transformation, first, this research integrates the theoretical spectrums of ecological modernisation, eco-Marxism and political ecology to examine how the local state and non-state actors tackle the conflicts between economic growth and environmental conservation (see Figure 3); second, it examines the dynamics and conflicts in land re-arrangement, policy design and implementation, technology promotion and soil degradation, and industry integration in the bamboo shoot production industry. To present the empirical findings, this dissertation is organised into eight chapters.

1.4 Structure of the dissertation

Chapter one has introduced the theoretical debates among ecological modernisation, eco-Marxism, and political ecology to examine the role and capacity of the state to tackle the policy dilemma of economic development and environmental degradation to achieve sustainable development. This integrative approach provides a holistic view: (1) to understand both enabling and disabling factors which affects the governing capacity of sustainable development, and (2) to reflect on the comments and environmental values of both state and non-state actors.

Chapter two is the literature review and a theoretical framework for the research (see Figure 3). It begins by critically exploring the meanings, structures, and processes of governance, highlighting the rich conceptual understandings, diverse forms of mechanisms and dynamics actors' interactions in governing processes. The chapter then proceeds to discuss the existing literatures on the environmental governance in Anglo-Saxon countries to illustrate how this concept is applied to frame problems and turn policies into actions and consequences. Finally, this chapter reviews the contribution of ecological modernisation, eco-Marxism and political ecology. Taking an integrative approach, this research devises an analytical framework to contextualise: (1) how state and non-state actors grapple with low household incomes, environmental degradation, and ecological limits through bamboo shoot cultivation, (2) how the state-centred and multi-nuclei governing structure co-functions to create new institutions, stipulates policies and projects to achieve synergy operation; (3) how the direct and indirect policy intervention of the state combines to create an incubating environment for multiple actors to produce new knowledge, standards, and industry's integration. This framework is useful for theorizing state and non-state actors' perceptions and practices to manage bamboo shoot resources economically, politically, and ecologically.

Chapter three introduces the research questions and research framework (see Figure 3). To contextualise China's local dimension of environmental governance, this research employs surveys, and in-depth interviews to incorporate state actors' perceptions and farmers' voices and combines both statistical data and policy documents with micro ethnographic analyses in a specific spatial and temporal context. Secondary and first-hand data are collected from Lin'an County in quantitative (e.g. survey) and qualitative methods (e.g. document and conversation analysis) and are used to analyse the data. Such diverse sources of empirical data in conjunction with mixed analytical methods provide insightful arguments which to answer the research questions.

Chapter four examines the deforestation and afforestation programmes from communism to market reform to understand forms of resource allocation and decision making in production processes. The Lin'an state decollectivises land ownerships and means of production from the hands of communes to individual farmers to capitalise bamboo shoot production. There are two major arguments for this institutional change: first, the re-organisation of land property transforms bamboo shoot farmers' cultivation perceptions and behaviours. Farmers enjoy more responsibilities and economic rights to make production decisions during market reform; they no longer produce bamboo resources for rural collectives. Instead, they could sell it to market for profit. Second, there is an observable tendency of the state to institutionalise forestlands' contracts, classifications, and marketisations. However, there are gaps between policy design and implementation of the land contracting system in Lin'an. Although the Lin'an state has distributed lands to individual farmers equally, it has caused the problems of smallholding of land and low productivity. Inefficiency in land adjustment, and ambiguity of the boundaries of lands has caused farmers' conflicts.

Chapter five elucidates how state-centred and multi-nuclei governing structure co-exist to produce an incubating environment for state and non-state actors to achieve socio-economic and ecological goals in the bamboo shoot production industry. There are two major arguments in this chapter: first, the prevalence of state-centred institutional arrangement underpins top-down policy steering; legal regulations, command and control cascade from central to local state to implement the nation-wide planning (e.g. Five Year Plan) and executes a legal instrument (e.g. Forest Law). The bamboo shoot governance structure demonstrates how State Forestry Administration's directives, legal regulations, and commands are delivered to the Lin'an Forestry Bureau to maintain the direct rule of Central State agency. Second, the Central State decentralises the rights for fiscal autonomy and responsibilities for local state to propel economic development. This initiates multi-nuclei governing structure for the local states to co-ordinate with different actors. In Lin'an, the local state collaborates with the forestry bureau (1) to establish new institutions (e.g. farmers' co-operatives, processors' associations, and bamboo shoot trading markets), (2) stipulate policies and projects, and (3) collaborates with farmers to create an environment to multiply farmers' incomes, attract investments, and increase vertical integration of the industry.

Chapter Six examines how the local state produces an incubating environment for multiple actors to implement policies, produce knowledge, and formulate production standards to grapple with the soil degradation problem (see Figure 3). Since the 2000s, soil degradation has exerted a growing pressure on the Lin'an state and Forestry Bureau to modernize the bamboo shoot production system through (1) the standardisation of fertilisers and pesticides usage, and (2) technological fixes of techniques including soil-cleaning, spatial re-arrangement of the plantation structure, substituting chemical fertilisers with organic ones, and replanting. There are two major arguments in this chapter: first, the Lin'an state

has tried to institutionalise production standards (e.g. hazard-free standards) to regulate the usages of fertilisers and pesticides in the bamboo shoot production system. The Lin'an state produces a synergistic environment among multiple actors (demonstration households, research institutions, and farmers'-operative) to institutionalise production standard needs. Second, there is a policy discrepancy between policy objectives and implementation because economic considerations out-overweighed the environmental consideration. The pro-growth mentality still drives producers to use a plethora of fertilisers which causes a large scale of land degradation to prevail in the system. This implies that the process of institutionalization of production standards is hindered by informalities and mismatch between policy objectives and implementation.

Chapter Seven presents how the Lin'an state integrates the production, processing and marketing sectors to (1) fix the overproduction problem and (2) increase competitiveness through vertical integration of production, processing and marketing sectors, (3) institutionalise production and processing standards to help producers and processors to comply with international and China's food production standards (see Figure 3). There are two major arguments in this chapter: first, the integration of bamboo shoot production, processing, and marketing sectors are driven by the state's policies and price instruments. The local state directly and indirectly uses industry integration to co-ordinate the standards of production from raw materials to finished products and uses market demands to increase producers' and processors' awareness food quality and safety. Second, there are gaps between policy design and operation to standardise bamboo shoot production and processing to comply with the quality assurance system. The practice of standardisation is fragmented and the impact of quality assurance systems takes time to diffuse from leading firms to small processing firms.

Chapter Eight summarises the findings of this dissertation and provides insights for the local dimension of China's governance of sustainable development in respect to (1) integrating both macro and micro scales of synthesis, (2) questioning the compatibilities between economic growth and environmental protection, and (3) critically reflecting on the values and perceptions of multiple actors in the bamboo shoot production system to search for sustainability trajectories in China (see Figure 3). Through the lens of ecological modernisation, the institutional analysis of land tenure reform (e.g. forestlands' marketisation and classification), institutionalisation of food production and processing standards, development of price instruments, and establishment of bamboo shoot market have demonstrated an observable tendency toward ecological modernisation. However, if we take the eco-Marxists' and political ecologists' critiques on informalities and ecological vulnerability, this research also identifies the social marginalisation and environmental degradation in the bamboo shoot production industry. Therefore, we should go beyond institutional boundary to reflect on the values of pro-growth mentality, and uneven distribution of social risks and benefits. This research identifies a deeper problem; that human-centred approaches may not be sufficient to tackle the environmental problems by emphasising technological fixes and engineering solution. Instead, we need to go beyond institutional boundaries in three major ways: (1) re-orient pro-growth mentality to proportional growth model, (2) consider the interrelationships between state and non-state actors to utilize human capital to tackle environmental problem, and (3) identify the policy roles and capacities of non-human actors (e.g. bamboo nature and technology, innovations and instruments) to seek socio-ecological solutions.

1.5 Conclusion

Bamboo shoot cultivation is considered as an effective development policy and vital part of the mountain economy in Zhejiang province. The study of the bamboo shoot production industry in Lin'an County provides a compelling case study of how the local state tackles two closely linked policy dilemma – land degradation and economic growth through the theoretical lens of environmental governance. This chapter presents an innovative research agenda as it calls for considering the local "governance of sustainable development" through integrating the ideas of ecological modernisation, eco-Marxism, and political ecology to tackle the policy dilemma between economic growth and environmental degradation. Their insightful ideas help this research to search for adaptive pathways to achieve socio-economic and environmental sustainability in China. In chapter 2, this research will explore the meanings of environmental governance and introduces the theoretical framework of this research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The literature review is tailored and organised to answer three central research questions: first, to critically address how state and non-state actors govern the bamboo shoot production industry in Lin'an; second, to analyse how the co-existence of both state-centred and multi-nuclei governance structures promote sustainable development policies in the bamboo shoot production industry; and third, to critically evaluate how the direct and indirect policy interventions of local state in Lin'an create an environment in which multiple actors struggle over low household incomes, environmental degradation, and the integrations of industry sectors. To answer these questions, the chapter reviews the literatures of sustainable development; environmental governances, and china bamboo studies literature to combine ecological modernisation, eco-Marxism, and political ecology concepts to better understand how sustainable development policies operate in the Chinese governance system. The concepts of sustainable development and environmental governance are closely related. The former requires a governance structure to create a conducive environment to operate sustainable development policies; and the latter needs multiple actors' collective actions and the synergy effect to achieve sustainable governance. Contextualising how the local Chinese state devised, delivered, and operated sustainable development policies provides insights on "governance for sustainable development" in China. Study of the bamboo shoot production industry in Lin'an County provides a compelling case study to understand how the local state drives sustainable development in land organisation, standardisation, and technology application in the bamboo shoot production industry.

This chapter is organised into six sections. Following the introduction, section two illustrates the concepts of sustainable development and governance. Section three examines the approaches and debates of ecological modernisation, eco-Marxism, and political ecology to achieve sustainable development. Section four elucidates the debates of environmental governance in China. Section five presents the central research questions. Section six provides the conclusion of this chapter.

2.2 The concept of sustainable development

Sustainable development has become a buzzword following the publication of the Brundtland report, “Our Common Future,” in 1987. It is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p.5). Although the concept of sustainable development has been criticized as ambiguous, meaningless, and anthropocentric (Richardson 1997; Krueger and Gibbs 2007), commentators still positively suggest that sustainable development provides a new paradigm for humankind to tackle environmental challenges (Jordon, 2008; Lafferty, 2014; Meadowcroft, 2007). For instance, Kates et al*.,* (2000) suggest the values of sustainability shape policy making and the decision process which open up practical and diversified possibilities to mitigate environmental challenges. Baker et al. (1997, p.6) and Lélé (1991, p.610) also argue that the concept of sustainable development provides vision for humankind to consider plausible directions to reduce ecological constraints to human livelihoods. Kates et al*.,* (2005, p.20) argues that the principles of sustainable development “are not fixed and immutable but the evolving production of a global dialogue…and have been broadened and deepened to include alternative notions of sustainable development (human and capital) and alternative views of nature (anthropocentric versus ecocentric)”. The understanding of sustainable

development is not static; it requires on-going debates and dialogues among scholars. Currently, there are three major strands of debates in sustainable development: (1) the debates on the roles of state and non-state actors (Campell, 1996; Commoner 1976; Lovins, 1997; Moore and Brand, 2003; Newman and Kenworthy, 1999), (2) the centrality between human and nature relations (Baker et al., 1997; Naess, 1973; Naess & Sessions, 1995), (3) the approaches of pro-growth and slow growth to achieve sustainable development (Daly 2008, 2010; Jonas and While, 2007; Kruger and Gibbs, 2007).

Although these debates provide approaches to achieve sustainable development, there is scant research that examines the interrelationships between sustainable development and governance. These include the modes of governance, steering approaches, and governing tools to achieve sustainability but are not well addressed. Jordon (2008, p.24) argues that there are very few studies to develop the “theory of sustainable development governance” and they lack the empirical studies to bridge the theoretical and empirical context of both governance and sustainable development (Jordon, 2008, p. 29). Farrell et al*.,* (2005) also argue that there are complementary roles between governance and sustainable development because governance is a means to steer and propel the process of sustainable development. Understanding the relationships between governance and sustainable development become a very important theme in environmental governance studies (Baker, 2014). The study of bamboo shoot production industry in Lin’an County provides two major research agendas to bridge the theoretical and empirical context of both governance and sustainable development: first, it provides a supportive case study to understand how local state and non-state actors re-organise land tenure, rejuvenate soil degradation, and integrate industry sectors in local governance structures. Second, it elaborates Jordon’s research agenda further by bridging the theoretical and empirical context of both environmental governance and

sustainable development through the debates among ecological modernisation, eco-Marxism, and political ecology.

The theoretical foundation of sustainable development is built upon the evolving ideas and perceptions of nature across different disciplines and intellectuals. Baker et al. (1997, p.10) explain that researchers should review how nature is debated and viewed in the past prior to understand the concept of sustainable development because the anthropocentric perspectives of environmental concerns become the backdrop and epilogue of sustainable development. During the industrial revolution in the 18th to 19th Centuries, humanity was positioned at the centre of the universe; nature was subordinated to humankind to satisfy human needs which resulted in widespread resource exploitation and environmental degradation in European countries (Biro, 2005; Harvey, 1996). At that moment, a strong anthropocentric view of nature dominated and nature was subjugated by human domination (Harvey, 1996). Until the 1950s, environmentalists showed weaker anthropocentrism due to more sympathetic and moral concerns such as the problems of population growth, resource scarcity, and usage of pesticides. However, concerns for nature were still subordinated to the human element; and for the sake of human benefits (Fox, 1990). For instance, following the Malthusian[1]ideology; Hardin's *The Tragedy of the Commons* argues that those self-interested individuals will easily exploit finite common resources including forests, fisheries, and pastures. Hardin (1968) argues that population control and legal restrictions are necessary to reduce the destruction of the commons. Boulding (1958) uses a spaceship as a worldview to arouse peoples' concerns for the finite resources in the earth; arguing that people

[1] Malthus' An essay on the principle of population was one of the earliest literature to concern resource scarcity and sustainability in relation to population growth. Malthus suggested (1993) two types of checks (raise death rate and lower death rate) to hold population growth within limits because resources cannot keep pace with population growth.

should live harmoniously with nature. Additionally, Carson (2002) unravels how pesticides are detrimental to the environment and arouses public concerns on the plethora usages of pesticides in the food production system. Until the 1980s, although the rise of environmental movements and deep ecology have initiated an eco-centric approach to concern the inter-relationships, environmental risks, and moral values between human and nature are reflected (Beck, 1992; Buechler, 1995; Eckerley, 1989; Naess, 1973), the impacts of eco-centrism are still confined to small groups of people and anthropocentric thinking is still dominant in mainstream environmental discourse (Asprem and Granholm, 2014, p. 307).

By reviewing how nature was perceived in the past, commentators suggested that there are two major understandings of nature: anthropocentric and eco-centric views (Baker et al., 1997; Richardson, 1997; Sarkar, 2005). In the anthropocentric approach, humankind holds a place above nature and exploits it, while the eco-centric approach regards humankind as part of nature and attends to more moral concerns for species' rights (Biro, 2005; Dobson, 2007). However, simply basing study on the human-centred and eco-centred paradigms is not sufficient to explain how the concept and policy decisions of sustainable development are shaped by the state and market mechanisms (Holden and Linnerud, 2007). Commentators develop different conceptual frameworks to understand the interrelationships among the state, society, and technology in environmental politics. For instance, Castree and Braun (1998, p.33) suggest that the production of nature is multi-faceted, mediated, and negotiated among different social class, gender, and ecology in different time and space. They suggest a social-nature approach: (1) identify how capital accumulation processes transform and produce nature into commodities thereby understanding how humans dominate on nature; (2) address the social construction and representation of nature through culture and discourse analyses;

and (3) examine how scientific studies co-produce nature. Braun (2006) and Castree (2009) critically reflect on the influence of eco-centrism and actor-network theory to go beyond human-nature dualism and realize the crucial role of non-human actors. Although Braun and Castree critically reflect the influence of eco-centrism and actor-network theory to go beyond human-nature dualism and realize the crucial role of non-human actors (e.g. science), there is still a lack of empirical studies to properly understand how a governance mechanism produces an environment to operate and implement environmental policies. Whitehead et al*.,* (2007) state that the nature approach provides more empirical analyses of the state-nature interactions in North America, Wales, and New Zealand. The state-nature approach stresses how a modern state employs standardised knowledge and technology (e.g. a map and the Geographical Information System) to collect information about nature for national production, planning and control. Although Whitehead et al*.,* (2007) attempt to understand how the state constructs nature politically and territorially through manipulating resource allocation materially and discursively. Connections between their empirical framework and empirical case study needs further elaboration on the role of science and technology in the state-nature paradigm.

To better understand the state-nature relationships, the school of innovation system and transition theory (Elzen et al., 2004; Geels, 2004; and Smith and Stirling, 2008) provide insights into how technological advancement can bring a socio-ecological transition. White and Wilbert (2006, p. 99) argue that technology and nature is indispensable to bring socio-ecological changes and it can be viewed as a co-functioning “techno-natural” process in which humans mediate, enact, and contest with techno-nature as a hybrid network. In line with this enquiry, Sassen and Dotan (2011) suggest a new approach called “delegating back to the biosphere” to examine the embedded capacities between nature and technology. These embedded capacities provide arenas to combine

the elements of nature with technological innovations to delegate the mitigation process back to nature. For instance, they illustrate the example of using algae to purify water, carbon-cycle, self-healing concrete, and landfill-gas to mitigate environmental problems. Yet, the above studies provide strong theoretical insights to address the interrelationships among the state, society, and technology; however, there is a lack of empirical understanding of how the governance of state can steer multiple actors and technology, make decisions, design and implement policies to achieve a sustainable transition. This research realises the importance of a governance of the state and non-state actors to make decisions, deliver policies, and take actions in order to achieve sustainable development.

2.2.1 The concept of governance

The word “governance” is an abstract noun coined from the word governs, with its Latin root meaning “steering” (Shapiro, 2012, p18). Governance is an umbrella concept for a wide spectrum of phenomena comprising “policy networks, public management, coordination of sectors of the economy, public management, public-private partnerships” (Pierre and Peters 2000, p.14). Rhodes (1997) informs that there are broad meanings and intellectual lineages of the notion of governance. For instance, Pierre (2000) argues that the meaning of governance refers to sustaining co-ordination and coherence among a wide variety of actors with different purposes and objectives. Bulkeley (2005) argues that governance is about a steering process, which involves a multiplicity of actors who have a “stake” in the governing processes. However, the vague and looser definition of governance raises commentators to critically assess its utility and implication (Kohler-Koch and Ritterger, 2006, p.28; Schneider, 2004, p.25). There are two major differences in conceptualizing governance in the European context. First, governance is different from government. Stocker (1998) argues that government

is a formal institution of the state-centred decision-making structure and legitimate coercive power. In this sense, government is the major decision maker and implements those decisions into rules and practices in particular governing structures. Governance implies broader meanings which involves (1) non-state actors in the governing processes (2) implies the meanings of governing transformation from top-down hierarchy to market and network forms of decision making (Evans, 2012, p.34-37). Second, governance is different from governing. Kooiman (1993, p.2) explains that governing is a way for "the purposeful effort to steer, control or manage sectors or facets of society" to translate policies into collective actions. On the contrary, governance depicts "the patterns that emerge from the governing activities of social, political, and administrative actors" (Kooiman, 1993, p.2). This research prefers to use the concept of governance to government for two major reasons: first, governance comprises broader conceptual meanings to examine how the state actors collaborate with non-state actors to manage resources and make decision to achieve collective goals and actions (Stocker, 1998; Rhodes, 1996; Rosenau and Czempiel, 1992, Pilbeam et al*.,* 2012). Second, it provides a theoretical bridge to understand how the concept of sustainable development is "variously interpreted and pursued in different policy/governance systems" (Jordon, 2008, p. 24).

Since the 1980s, the role of states in European countries has experienced hollow out coupling with the shift from government to governance. New modes of governance not only go beyond institutional boundaries but also the state reduces command-and-control frameworks and increases the use of market and participatory instruments (Higgins and Lawrence, 2006; Tietenberg, 1998). According to Pierre (2000 pp.4-5), there are two major modes of governance under economic restructuring: state-centric and society-centred. He explains that state-centric refers to the governance which "steers society and economy through political brokerage" and by "setting goals and making priorities." Society-

centred governance emphasises co-ordination and self-governance in the form of public-private partnerships and public participation. Evans (2012, pp.34-35) argues that the transition of the European state has changed from hierarchical modes to network and market modes of governance to manage resources and environment. Lemos and Agrawal (2006, p.298) further argue that there are closely linked modes of governance, multiple actors, and environmental outcomes. There is “a set of regulatory processes, mechanisms, and organizations through which political actors influence environmental actions and outcomes.” Their understandings provide insights for this research to address the major actors and governing tools to steer the sustainable policy in the governance mechanism.

Since the 1980s, OECD countries have demonstrated an observable transition from traditional regulatory, state-centric and end-of-pipe approaches to more polycentric and decentralised modes of governing marked by collective actions of non-state actors to manage environment (Bulkeley and Kern 2006; Evans 2012). Some commentators argue the decentralisation of state has increased the institutional capacity, efficiency, and accountability of European countries to fix environmental problems (Dryzek, 1997; Mol and Spaargaren, 2009; Kooiman, 2000). These incremental institutional capacities include participation of civil society, emergence of new governing institutions (e.g. European Environment Agency, Intergovernmental Panel on Climate Change), market instruments (environmental subsidies and taxes), and rational modes of production (Dryzek 1997; Gouldson et al. 2008; Hajer 1995; Mol, 1995; Jänicke, 2008). However, other commentators argue that the decentralisation of state has accelerated neo-liberalism (e.g. privatisation of state services and de-regulation) and induced the failure of environmental policies, which increased resource exploitation, environmental problems, and class displacements (Keil and Boudreau, 2003; Gunningham, 2009; Raco, 2005; While et al., 2004). The failure

of environmental policies has triggered social movements to overturn public policy decisions in relation to toxic waste management and large-scale development projects. This also arouses scholars to pay attention to how local environmental problems induced governance changes from below (Pastor, 2009).

Although the above studies have demonstrated how the term governance is used to understand the role of state and non-state actors in dealing with environmental problems, there are three major theoretical gaps which need further investigations: first, there is a weak bridging between the theoretical and empirical context of both environmental governance and sustainable development (Jordon, 2008). Particularly, how sustainable development policies, operated and implemented by state and non-state actors in the governance mechanism needs further research. This research proposes to combine ecological modernisation, eco-Marxism, and political ecology concepts to develop an integrative framework to understand how sustainable development policies are operated in the Chinese governance system at the local level. The major reason to adopt this combination is because their debates contribute to the theoretical understandings of the role of state, market, and technology in searching sustainable development. These debates provide relevant dimensions to conceptualise the governance of sustainable development in China. However, three approaches are lacking within the empirical case to evaluate how the role of state and non-state actors operate policy and market instruments to achieve sustainable development at the local level. The bamboo shoot production industry in Lin'an China provides a local case study to contextualise how state and non-state actors re-organise land arrangement, rejuvenate soil degradation, and integrate industry sectors to achieve the governance of sustainable development.

Second, Chinese environmental governance is different from European countries because of its socio-political context (Mol, 2006). Commentators argue that the European states are experiencing transition from hierarchical command-and-control to non-hierarchical steering by multiple actors (Börzel and Risse, 2010; Smismans, 2008); changes from state-centred to the hollowing of state (Rhodes 1994), and adjusting the various roles of state to respond to neoliberalism (Pierre, 2000). Although the Chinese governance system has demonstrated decentralisation, commentators argue that the decentralisation process is mainly operated in economic aspects, which has been accompanied by a strengthening of China's unitary political system (Huang, 1996, pp. 665-672). Therefore, the case study of the bamboo shoot industry in Lin'an provides a local context through which to theorise how state and non-state actors interact within the command-and-control and non-hierarchical multiple actors' steering system to achieve sustainable development. Additionally, contextualising how sustainable policies are devised and operated within state-centred and multiple-actors' governing structures contribute significantly to the understanding of the governance of sustainable development in China.

Third, although the major theme in environmental governance studies is to understand how the governance mechanism in responding to environmental transition, reduction of socio-ecological collapse, and the needs and opportunities of future generations operates (Whitehead, 2014); there is a co-existence between diverging analytical approaches and theoretical overlapping (Davidson and Fickel, 2004). For instance, different political values of ecological modernisation (libertarian), eco-Marxism (egalitarian), and political ecology (political economy) engrained their own approaches to analysis (1) the role of state and market, (2) the use of technology, and (3) the trajectory to achieve sustainable development. However, this research has identified four major theoretical commonalities among these three approaches. First, the three

approaches agree that the process of governing has transformed from state-centric to more polycentric and decentralised means of governing marked by collective actions of non-state actors. Second, three theoretical strands are aware of the Cartesian dualism of human and nature relationships by taking a "pluralistic or networked form of thinking" to understand interdependency and co-functionality among biotic and abiotic actors in a complex network (Rocheleau and Roth, 2007; Sheppard, 2008). Third, these three approaches provide heuristic framings on environmental problems through questioning the impacts of neo-liberalism, globalised industrial activities, decentralisation of the role of state, the participation of environmentalists, civil society and non-government organizations (NGOs). Fourth, both approaches respond to the "post-structural turn" by absorbing reflexive and relational ontological thinking and applying their research in an interdisciplinary paradigm to understand the causalities, metabolism, and dynamism in human-nature interactions (Robbins and Marks, 2010; Whatmore, 2006).

2.3 Theoretical debates and approaches

2.3.1 Ecological modernisation

Ecological modernisation recognizes the processes of institutionalisation of environmental practices in European countries with partnerships among governments, businesses, environmentalists, and scientists (Dryzek, 1997; Mol, 1995). These processes include changes to the modes of production and resource distribution through technological innovation and market signals. The notion of "ecological modernisation" explains how industrialised societies tackled the environmental crises after industrialisation in the 1980s. Ecological modernisation originated in Germany's environmental debate on using

technological innovations to fix environmental problems. According to Andersen and Massa (2000), the term ecological modernisation was coined by two political scientists - Joseph Huber in a book titled *The Rainbow Society and Ecology* and Martin Jänicke's research article titled "*Environmental Prevention as ecologic modernisation and structural policies* (Buttel, 2000)". The idea of ecological modernisation was further outlined by Brunowsky and Wicke and further developed into a social theory by Arthur Mol and Gert Spaargaren in the 1990s (Buttel, 2000). It is an analytical framework and school of environmental thought to be applied in policy making and environmental management (Hajer, 1995). Spaargaren and Sonnenefeld (2009) argue that there are three stages of intellectual development within ecological modernisation: the first stage of ecological modernisation stresses "technological-fix" as a governing tactic to tackle production problems; the second stage stresses collaboration between the role of state and market to tackle environmental problems; the third stage of development emphasises policy transfers, including theoretical frameworks, technologies and experiences of ecological modernity from OECD countries to developing countries. There are five major essences of ecological modernisation: first, knowing industrial development is compatible with environmental conservation; second, utilizing institutional capacities and technological advancement to tackle environmental problems; third, searching for a rational and reflexive mode of industrial development; fourth, reconciling the binary understanding between society and nature; and fifth, addressing the changes in environmental behaviours and practices (Hajer, 1995; Mol, 1995; Mol and Sonnenfeld, 2000; Jänicke, 2008)

2.3.2 Eco-Marxism

The traditional Marxist argues that economic development drives labour exploitation and environmental crisis under conditions of specific historical materialism. Benton (1989) and O' Connor (1998) explain that capital accumulation produces the risks of overproduction and underproduction which in turn causes resource depletion and environmental degradation (O'Connor, 1998). Eco-Marxists contribute to contextualising our ontological understandings of nature as commodities, which are attached to specific exchange values and production relations (Castree and Braun, 1998; Smith, 2008). Key thinkers in eco-Marxism appeal to the emancipation of human domination in nature because capitalists co-modify nature and create a second nature to sustain capital accumulation (Smith, 2008). The commodification of nature not only produces resource depletions and pollutions but also fails to maintain harmonious social and material conditions (e.g. environmental degradation worsens citizens' health) (O' Connor, 1998, pp. 238-300; Harvey, 1996, pp. 133-135).

As Marx and Engels (1975) capitalists' productions alienate labour (labour may be forced to sell their body power for wages) and nature (attached to exchange values) as objects and commodities respectively. When examining the production relationships among nature, state, and non-state actors in environmental history, eco-Marxists beware that the dominating class manipulates nature as both a tap for more resources and a sink for pollution (O'Connor 1998). Eco-Marxism provides a critical angle to situate the state's development and resource exploitation projects in specific historical geographical frames. In so doing, eco-Marxists employ network analyses to question different types, patterns, and degrees of power relationships operating in a multi-scalar manner (Castree, 2002; Rocheleau and Roth, 2007, Swyngedouw, 2007). For instance, Few (2002, p.30) employ actors' analyses by elucidating how the

dominant class reproduces domination to be exercised spatially and “driv[e] people, institutions, and social structures to become entangled” within material spaces”. Swyngedouw and Heynen (2003) question how the human-nature dualism and asymmetrical social relationships create environmental injustice.

Eco-Marxists were being critiqued by post-structuralism for human-centrism in discussions without recognising (1) importance of non-human actors, (2) seeing society has been broken down into a series of overlapping webs or networks of activities (Braun, 2009; Latour, 2007). To respond to post-structural’ critiques, eco-Marxists propose the theory of socio-environmental metabolism (Swyngedouw, 2007), Second Crisis Theory (O’ Connor, 1996); and incorporate actor-network theory to incorporate the role of human actors (Braun and Castree, 2005; Castree et al*.,* 2009). With regard to perceptions on technology usage and environmental limits in capitalist production, eco-Marxists are sceptical about the technological-fix and ecological scarcity. This is because more technological advancement means more resource exploitation and wastage; and they perceive scarcity problems as socially constructed by the dominant class (Harvey, 1996; O’ Connor, 1998).

2.3.3 Political ecology

Political ecology brings politics into consideration to understand society and environment interactions. According to Blaikie and Brookfield (1987, p17), political ecology concerns both ecology and political economy. The term “political ecology” was first coined by anthropologist Eric Wolf in a research article titled *Ownership and Political Ecology* (Watts, 2003). Piers Blaikie’s works further contributed to this field in three major ways: (1) integrated political economy perspectives in environmental science (Robbins and Bishop, 2008), (2) bridged

the structuralist and post-structuralist debates with network analyses (Grove, 2009) and (3) adopted a multidisciplinary approach to address local knowledge and practical alternatives to developmental issues (Simon, 2008). Paulson et al*.,* (2003) and Robbins (2004) provide succinct reviews of the intellectual genealogies of political ecology. Mid-20th century scholars theorized that political ecology had diverged from environmental and cultural determinism, which claimed that climatic factors influenced civilisations. The deterministsʼ approaches naturalised the domination of the powerful group and justified processes of colonisation. By assuming inevitability, the practice of colonialism comes to appear apolitical (Robbins, 2004, p.19). Combining political economy approaches with ecological studies opened up opportunities for research on opaque actors such as farmers and yielded more research on colonial and post-colonial systems, power and discourses, environmental justices, global and regional governances as well as marginalised groups in developing countries (Bryant and Bailey, 1997; Fairhead and Leach, 1995; Robbins and Sharp, 2003; Scott, 2008; Swyngedouw, 2008). Concerning the themes of political ecology from geographical perspectives, Zimmerer and Bassett (2003) elucidate understanding of social-environment interactions and the production of scale. Yet, Bryant and Bailey (1997, p.30) argue that the goals of political ecology in geography are to examine “marginality, vulnerability, and risk” to the marginalised groups in everyday and episodic bases.

2.3.4 Role of the state and market mechanisms in allocating resources

Ecological modernists stress collaboration between the role of state and market to allocate resources efficiently and explore the institutional capacities to search for rational modes of industrial development (Cohen, 1998; Lundqvist 2000). Ecological modernists believe that maintaining economic efficiency is

compatible with improving environmental problems. Specifically, ecological modernists depend on collaborative roles to employ policy and market instruments including ecological accounting, green GDP, green production and environmental impact assessment. For instance, Hanley et al. (2009) propose the use of a pricing system to economise the natural resources. Lomborg (2001) further argues that sustaining economic growth and utilizing human capacity of ingenuity and innovation will tackle the environmental crisis. Both examples emphasise the role of the market to price ecological services signifying the potential of human and ecological services to solve environmental problems. To manage negative externalities in the market system, ecological footprints, sustainability indicators and environmental impact assessments are important tools to signify scarcity, substitutions and technological innovations of natural resources (Collins and Flynn, 2008; Wackernagel and Rees, 1996). Eco-Marxists also argue that the state plays a vital role in the mediation of the flow of capital and the transformation of nature. The state is regarded as the interface between capital accumulation and nature exploitation; ruling classes possess the means of production and productive force. Eco-Marxists are doubtful of the notion that the market can tackle environmental problems because no matter whether there is capital underproduction and overproduction, capitalists keep exploiting nature to maintain material commodification and profit growth (O' Connor 1998). Therefore, eco-Marxists question the effectiveness of the market system to price the intangible negative externalities and its destructive nature of capital accumulation. Harvey (1996) argues that using the pricing system creates asymmetrical social relations because monetary value discriminates over who can accesses resources and naturalize rights of exclusion in the capital accumulation process. The laissez-faire economy ignores class exclusion, power domination, and gender differences. However, other eco-Marxist commentators emphasise the role of a strong state to regulate the market system. This is because a strong state facilitates the redistribution of social resources; creates

spaces for lower classes to sustain their lives, and increases social inclusion (Raco, 2007). Hawken et al. (1999) further argues that combining strong governance with the market price systems of resource allocation and pollution management can minimise waste and toxic substances. With increasing state control governance, natural capitalism is promoting eco-efficient production processes, reusing materials in ecosystem, moving from quantity to quality growth, and utilising the ecological services to restore the natural resources. For instance, green investment offers financial support to climate protection, provides funding for LDCs to increase energy efficiency, polluter-pay system and green taxes (Hawken et al*.,* 1999).

Additionally, the prolific debates between ecological modernisation and eco-Marxism on the compatibility between economic growth and conservation not only unravel socio-economic problems such as resource exploitation and class suppression but also inspire future research to ponder how a strong state can provide better resource allocation to tackle environmental problems. This integrative approach can help this research to further explore compatibility between environmental protection and economic development. Particularly, the bamboo shoot industry in China provides a unique case study to understand to what extent both strong state and market mechanism propel economic growth and environmental conservation to govern both environmental challenges and solutions, and realise production limit and growth.

2.3.5 Debates on the role of technology innovations

Ecological modernists emphasise the role of technological innovations in response to environmental crises and resource depletion. Technological innovations include scientific indications, environmental management systems,

and clean technology applications as useful devices to solve environmental problems (Andersen and Massa, 2010; Mol 1995; Sonnenfeld, 2002). Case studies on using technological innovation to solve environmental problems in post-industrial European countries include the Dutch chemical industries, Denmark's green tax reform and Germany's precautionary management of harmful materials (Anderson, 1994; Boehmer-Christiansen, 1994; Mol, 1995). These case studies show environmental transformations from polluted industrial practices to eco-efficient production (Dryzek, 1997; Gouldson et al., 2008). However, eco-Marxists are dubious about the use of technological innovations to solve environmental problems because capitalists aim at using technology to break the bottleneck of production to (1) increase surplus value, (2) reduce the cost of materials and (3) facilitate capital accumulation (Castree, 2000; Smith, 1998). In the eyes of capitalists, technology is used to *remake* nature in ways which sustain profitability and capital accumulation (O' Connor, 1998). In this sense, remaking means more access to nature in order to "tap" more raw materials and "sink" the pollutions into nature (Harvey, 1996; O' Connor, 1998). In an era of increasing complexity in human-nature relationships, political ecologists go beyond the anthropocentric connotations of whether technology is constructive or destructive dualistic understanding by proposing a co-constitutive thinking to see human and technology as equally important actors to shape human-nature relationships. This perspective embraces the vibrancy of technological innovation as a *subject* to co-produce a series of socio-ecological changes. For instance, Bennet's (2010) "vital materialism", Braidott's (2013) "post-human subject" challenge how humanistic ontology produces dualistic understandings among human-technology relationships. Rather, identifying arrays of human and non-human actors (i.e. nature and technology) are growing attention to environmental governance to co-produce viable socio-ecological solutions.

2.3.6 Debates on the role of state and non-state actors

The major theoretical difference among ecological modernisation, eco-Marxism, and political ecology approaches is the path to achieve sustainable development (see Table 1). Ecological modernists argue that structural changes are not a necessary pathway to achieve sustainable development; instead, exploring institutional capacities to search rational modes of development is the priority. Ecological modernists emphasise the concepts of reflexivity, rationality, and risk society to redevelop dynamic relationships among social actors in different production and consumption cycles to increase institutionalisation of environmental practices. These concepts stress the rationalities of human actors to mitigate and rehabilitate environmental problems. There is a win-win ecological rationality in the best use of human factors (capital and technology) and environmental factors (raw material and energy resources), which can flexibly and effectively achieve sustainable development. For instance, green consumption practices, shopping behaviours and carbon trading are a prime example (Spaargaren and Vliet, 2000; Oosterveer et al*.,* 2007; Spaargaren and Mol, 2013). Maintaining a pro-growth paradigm through market mechanisms and technological innovation can facilitate resource allocations to achieve sustainable development (Baker et al., 1997; Richardson, 1997).

However, eco-Marxists believe that structural change is necessary to restructure the “exchange value” market system to a “use value” eco-socialist system through social movements utilising the “eco-socialism” approach (Kovel, 2006). This approach should be internationalised across all nations through dialectical means of spatial production and socio-political processes (Pepper, 2010). Eco-socialism allows the working class to reclaim rights from the ruling classes’ hands including the right to own the means of production, access natural resources, and enjoy the use value of material goods (Lefebvre, 1968; Mitchell,

2003). To materialise the eco-socialism approach, Schweickart (2002) suggests developing a *successor-system*, which is a transition from capitalism to a socialism society. This idea calls for a structural transformation with collective actions through nationalising the banking systems, and formulating the capital assets tax system. There are two major criteria for building an adequate successor system: first, this system should be economically and ethically superior to capitalism; and second, this system should enable economic experiment and be envisaged as a structural transition.

Krueger and Gibbs (2007) and Swyngedouw (2007) critically show that the pro-growth paradigm is not able to reach social and environmental sustainability because relentless growth tends to exacerbate resource depletion and pollution problems. However, taking a de-growth development path and building metabolic relationships with nature can achieve sustainable development (Keil, 2007). Swyngedouw (2006) suggests understanding social-environmental interactions as a metabolic process in which human and non-human actors co-produce nature and the means of production dialectically. This interaction emphasises use-value rather than an exchange-value metabolism.

We should go beyond the impasse between whether the state should go through a restructuring or institutional reform to reverse destructive productions. Recent theoretical development in political ecology provides insights to reorient the sustainability debates from the state or people-oriented understanding to explore the potentials of nature to solve environmental problems. In doing so, political ecologists recommend: (1) combining both structuralist and post-structuralist perspectives in order to examine biophysical and bio-economical changes in rural-urban, industrial, and global North and South settings (Swyngedouw and Heynen, 2003; Zimmerer and Bassett, 2003); (2) adopt a multi-disciplinary approach to explore integrative theoretical perspectives to solve

environmental problems; for instance, engagement the traditional sciences, material ecologies, and complexity theories to look for practical solutions and ponder alternatives (Rocheleau, 2008). The scope of political ecology stresses the “co-evolving” approach between human and non-human actors to search for sustainability pathways (Keil 2007; Rocheleau, 2008). Nature is not a passive agency; it has a vibrant agency to co-produce governing capacities, environmental actions, and eco-efficient spaces.

Table 1 Comparing Eco-Marxism, Political Ecology, Ecological Modernisation

Key approaches to understanding sustainable development and governance	**Eco-Marxism**	**Political ecology**	**Ecological Modernisation**
1. Theoretical tradition and reasoning	• Hegelian: conflict and critical theory • Dialectical reasoning • Egalitarianism	Materialism: adjust between modernisation and traditional ways of development	Environmental sociology and reflexive modernity
2. Centre theoretical question on sustainable development	How does capitalism produce and reproduce nature for accumulation?	What causes ecological cost? Who benefits from conservation efforts and who loss?	How does the increase of institutional capacity of capitalist economy improve ecological outcomes?
3. Approaches to analyse sustainable development	• Dialectical approach to reconcile human-nature dichotomy • Critical reflection on the impacts of human-domination on nature e.g. commodification process • Socio-ecological metabolism • Critiques on technical fixes	• Integrative approach by using actor-network theory and other social theories • Normative understandings of environmental causes rather than symptoms • Address ecological degradation and social marginalisation	• Institutional and policy analysis • Quantitative analysis of waste and emissions (e.g. cost and benefit analysis) • Address technological innovation (e.g. clean technology), environmental management system, and market

			through research on changing fortunes of local people & the landscape they are living in • Critical assess on the role of technology	mechanism (e.g. green tax) • Awareness of the potential of technological fixes
4.	Perception of nature and society	• Capitalists exploit the nature and working class produce alienation, human-nature dichotomy	• Environmental change is the product of political processes • Understanding non-human nature is crucial to the co-production of socio-nature	• Economic development is compatible with environmental conservation • Rational and reflexive mode of industrial production is possible
5.	Theoretical tensions	• Ignores technological-induced social change • Critically reflects on how materials affect governance structures but lacks of conceptual apparatus to document in agency daily practices	• Identify patterns but which cannot explain the relationships between actors and environment events • Over-emphasis materials and ignores the role of ecology	• Ignores the power dynamics and structural constraints in the Chinese social structures • Not able to respond to social inequity and environmental justice issues

6.	Key decision maker to achieve sustainable development and actors' relationships	• Big state to distribute resources and delegate directives through command-and-control mechanism to achieve eco-socialism	• Multiple actors, which linked up both top-down and bottom-up approaches. More emphasis the role of grassroots and non-human actors	• Local government and NGOs to encourage horizontal and bottom up approaches
7.	Steering approach	• Planning and control through a big state and small market	• Network management involving multiple actors which pay more attention in local conditions	• Network governance with key actors which pays more attention to how key players such as the state and industrialists plus market instruments
8.	Policy design and implementation	• Awareness of qualitative environmental changes, social justice and class exploitation • Socialist state determines the implementation process	• Combine both professional and lay knowledge • Questions scientific knowledge and policy dynamics • More emphasis in the bottom up implementation process and diversity	• Emphasise scientific knowledge, risk analysis, and societal knowledge • Leading actors discern inclusiveness of the implementation process

2.4 Debates on environmental governance in China

Since the 1978 market reform, the governance of the Central State has decentralized from hierarchical central planning to a more market-oriented structure from a closed-door policy to growing openness with the outside world, and from centralisation to developing more capacities for citizen participation (Carter and Mol, 2007; Friedmann, 2005; Shapiro, 2012; Lee et al*.,* 2012; Logan, 2008; Wu, 2007). This transition has attracted researchers to attempt understanding the transformation of Chinese environmental governance system under market reform. There are two major theoretical strands to conceptualise Chinese environmental governance mechanism: the first strand of conceptualization is to compare the European notion of governance in relation to the role of state, institutional reform, market dynamics, involvement of non-state actors, and functions of non-government organisations (Mol and Carter, 2006; Johnson, 2008; Marsden et al*.,* 2011). Mol (2006) argues that there are similarities and differences between the transition of environmental state in both China and European countries. For similarities, they are increasing decentralization and shifting away from command and control to flexible steering in environmental management. The institutionalising of market instruments includes food production and ISO standards, Green GDP, and price mechanisms (Economy, 2006; Keeley, 2007; Rock, 2002). For differences, Beach (2001) argues that decentralisation of the Central State doesn't mean the local state would prioritize environmental conservation before economic development. Economic rationality still dominates in the transition of the Chinese state. Mol (2006) further responds that, although Chinese environmental governance is unique in its administrative-led transition, inactive participation of non-state actors, and full informal social interactions; China is putting more resources to propel environmental reform. For the tools of analysis on environmental governance in China, scholars in this strand of study conduct institutional

analysis (both top-down and horizontal approaches), policy research, and statistical evaluation to understand the institutional environment and management of the network form of governance. This group of scholars questions the sustainable development in China by examining how the collaborations of key players include state officials, scientists, industrialists, and NGOs to employ market instruments to price ecological services, to devise innovative technology for cleaner production, and institutionalise environmental practices through legal enactment and enforcement.

The second theoretical strand is to conceptualise Chinese environmental governance from below through an examining of the local particularities rather than comparing with European countries. This strand of study examines the actual experiences and environmental values of state and non-state actors in resource management (Wainwright, 2013; Weller, 2006; Tilt, 2010). To analyse actors' lived experiences in environmental changes, this strand of study draws on the political economy approach to combine existing literature with in-depth engagement with actors and their actual experiences to analyse environmental changes. This strand of study tries to go beyond institutional boundaries to conduct research to demonstrate the negative impacts of policies and market mechanisms toward the vulnerable group and local people in a bottom-up manner (Robbins, 2006). This approach highlights the conflicts between development and conservation, marginalisation of vulnerable groups and the degraded environment in which they are living (Coggins, 2003; Ho, 2005; Vermeer et al*.,* 1998; Tilt, 2006 and 2008). The challenge for taking a local perspective involves intensive observation in a particular research site that can obscure a holistic or macro view of the phenomenon (Smart, 2006). By recognising the weakness of a local-centric outlook, this study not only focuses on in-depth observation of actors' interactions (local scale) but also combines it with macro-statistical data and institutional analyses to provide a more holistic

research picture. By bringing together top-down and bottom-up approaches, we can examine the trend of Chinese institutional transition and decentralisation processes. Combining both top-down and bottom-up approaches, we can examine the trend of Chinese institutional transition, top-down direction, and decentralisation processes. On the other hand, we can examine through actors' perceptions and experiences of policy implementation and co-ordination in environmental governance and changes from a bottom-up manner.

Conceptualisations of Chinese environmental governance are not confined to comparing with European countries and contextualising local particularities in relations to role of state and non-state actors in decision-making, policy design, and implementation. Commentators also pay attention when examining how the roles of local state and market steer resources (e.g. land and forest) to achieve the governance of sustainable development under market reform.

Current studies on the steering approach in Chinese governance are divided into state-led or market-led approaches to resource allocation and management. To understand the state-led resource steering approach, commentators tend to document how the state propels institutional reform to search for better resource arrangements (Wang et al*.,* 2007; Trac et al*.,* 2007, Xu, 2006). For instance, researchers evaluate how the state promotes environmental policies, enacts and enforces environmental laws; implements ecological programmes, and provides subsidies to boost the incentive of environmental protection (Benette, 2008; Xu and Ribot, 2004, Xu et al*.,* 2004; Yamane, 2001). Additionally, other commentators specifically examine how local states have paid attention to ecological restoration (e.g. increase forest coverage and biomass) (Rudel et al*.,* 2005; Zhu, 1997; Piao et al*.,* 2009). Studying the state-led approach in resource allocation provides normative understanding of

the hierarchical top-down policy execution and control in policy delivering and monitoring. However, there are two major theoretical tensions of this state-led analytical approach: first, this approach understands hierarchical top-down governance as a generic functionalist process from central down to local but it neglects the unintended consequences of policy delivery and lack of governability of this state-led steering at the local level (Black, 2008, p.4). Commentators (Lin and Ho, 2005; Lin, 2009) argue that there are conflicting interests among multiple-levels of governing institutions, resistance, and renegotiation of rules and regulations from the local state in China. Second, the state-led analytical approach neglects the discussion of the increasing role of the market in China.

In order to understand the important role of the market in resource allocation, commentators tend to document how the market mechanism has created a price system for state and non-state actors to allocate resources. For example, studies of China's agricultural market have drawn the attention of scholars to (1) ruminant markets such as beef, sheep meat, dairy, wool markets; and (2) cash crop markets such as grain and tobacco (Brown et al*.,* 2002 & 2005; Delman, 2003; Longworth and Brown, 1995; Wang, 2009). These studies contextualise the role of state and non-state actors under market-led changes to resource allocations by highlighting the state-economy relationships. This group of studies provides three major insights: they understand the transition of agricultural products from a planned economy to market reform; they document the global-local dynamics on the products' value chains, and they examine the state and non-state's negotiation on market prices, rules, and products. Additionally, commentators in market-led analytical approach appeal to public-private partnership and privatisation of state resources with well-defined property rights in land arrangement to safeguard long-term agricultural productivity, guarantee efficient resource allocation, and environmental sustainability in China

(Brandt et al., 2002; Gao, 2004; Prostermand et al., 1996). For instance, scholars argue that with properly defined property rights in land arrangement, this can reduce environmental degradation and food security problems in China (Ash and Edmonds, 1998; Brown, 1995). Although the latest debates in market-led analytical approaches have included more state actors' perspectives and cultural perspectives to expand the state-economy analyses into a wider framework thus examining state-economy-society relationships (Alpermann, 2010 and Lingohor, 2007); there are limited insights and approaches to reflect how the state designs and implements policies and steers non-state actors and market mechanism to distribute natural resources.

2.4.1 Research framework

The debates among ecological modernisation, political ecology and eco-Marxism not only exceed the state-led and market-led dualistic analytical approach but also provide better theoretical lenses to understand the decision-making process, steering approach, role of technological fixes, policy design and implementation of sustainable development in China.

2.4.2 Role of the state in implementing sustainable development policies

Ecological modernists argue that both the role of the state and market mechanisms are important to produce a conducive policy environment for China to conserve its environment (see Figure 4). For instance, the strong role of state plays a crucial role to enact and enforce environmental regulations, propel institutional reforms, establish new environmental institutions, and promote

quality assurance and production standards (Mol 2006; Ho, 2006; Lo and Tang, 2007). Through a win-win rationality the best use is made of human factors (market and capital) and environmental factors (raw materials and energy resources), and by doing so the state institutionalises environmental practices in production processes and markets. For instance, the state establishes food production standards to insure better quality and safety of food production processes in China (Trienekens and Zuurbier, 2008; Wang et al., 2008). According to Fulponi (2006, p.2), "standards are important part of the governance structure of the food system because their implementation determines how food is produced, processed and delivered to the consumer". Understanding the institutionalisation of food production standards in China provides two important insights on governance: (1) understand how the state collaborates with local industrialists to be compliant with technological competencies, international standards, and food safety admittance systems (Bai et al*.,* 2007); (2) address how the state delivers regulations and rules in both top-down hierarchy and horizontal interactions to achieve efficient management and environmental-friendly production (Boström and Klintman, 2006, p.165). Apart from institutionalisation of environmental standards, the state also employs public-private partnerships and market instruments to involve non-state actors to mitigate and rehabilitate environmental problems. These market instruments include price, environmental accounting, ecological auditing, environmental fees, green tax, tradable emission permits, and green GDP (Angle and Rock, 2009; Economy, 2006; Mol, 2006; Ma and Orolano, 2000; Rock, 2002). However, both the eco-Marxists and political ecologists are doubtful about the effectiveness of the Chinese state and market to mitigate environmental challenges because of a number of policy defects (see Figure 4). These policy defects include environmental injustice, social inequality, gaps between policy design and implementation, and lack of citizen participations in policy-making processes (Lee et al*.,* 2012; Solinger, 2006; Jiang, 2005 and 2006, Yeh, 2009). It is very

unlikely that Chinese market mechanisms will be able to solve the uneven distribution of economic benefits and environmental harms or health impacts of ethnic minorities and marginalised groups (Caprioni 2012; Tilt, 2010; Wainwright, 2012; Wesoky, 2012).

Situating debates on the role of state and market among eco-modernists, eco-Marxists and political ecologists in this study; this debate recognises both enabling and disabling factors which can facilitate or limit the state's capacity to institutionalise environmental practices and use market mechanisms to mitigate environmental problems. Apart from addressing the roles of state and market to steer environmental changes, debates on the role of technology resurfaces when exploring China's sustainable development. From the perspectives of ecological modernists, eco-Marxism, and political ecologists, they provide insights on how the role of technology to produce both productive and destructive forces which influence the governing capacities of the Chinese state.

2.4.3 Role of technological fixes in the socio-economic system

The debates among ecological modernists, eco-Marxists, and political ecologists in China provides insights into how the role of technology can produce both productive and destructive forces to influence the governing capacities of the state to tackle environmental problems (see Figure 4). Ecological modernists understand technology as a productive force to increase efficiency in resource allocation, reorient production to cleaner methods (e.g. clean coal technology and local carbon production), increase food security and agricultural productivity (e.g. biotechnology, green labelling and ISO certifications) (Chen et al., 2010; Hits and Dietmar, 2007; Keeley, 2006; Mol and Carter, 2007, Ross, 1998; Sanders, 2006; Zhang and Crooks, 2012). These productive forces increase the

governing capacities of the Chinese state to respond to environmental crises and resource depletion. Therefore, ecological modernists promote policy transfers, institutional changes, technological transfers and alternative agricultural practices (e.g. water saving irrigation technology and water foot-printing) between the OECD countries and China (He and Ortolano, 2006; Ohshita and Ortolano, 2006; Hubacek et al*.,* 2009; Marsden et al*.,* 2011). However, eco-Marxists and political ecologists examine the underlying dynamics and destructive forces of nature's politics, the discursive meanings of science and technology in order to understand how they are used to legitimize the state's environmental policy to transform resource users' behaviours and extend state control (Edmunds et al., 2013; Tilt, 2010; Blaikie and Muldavin, 2004; Yeh, 2009).

Eco-Marxists and political ecologists understand the state's environmental programmes as "governing tactics" which induce environmental unjust identities and memories' reproductions in the state's environmental programmes such as Slope Land Conservation Programme, National Forest Protection Programme and Rangeland Conservation Programme (Boland and Zhu 2012;Yeh, 2009; Jiang, 2006). Eco-Marxist and political ecologists unravel how destructive forces in environmental programmes have transformed resource users' perceptions and experiences. For instance, Wainwright (2012) documents how farmers perceive the ill effects of green revolution that causes cancers and Tilt (2010) examines how workers perceive and adapt to industrial wastes and pollutions in their daily experiences (see Figure 4).

In fact, ecological modernists, eco-Marxists and political ecologists are reflexive and critical by considering both productive and destructive forces caused by technological innovations. The bamboo shoot production industry in Lin'an County provides two relevant case studies to critically question the role of early shooting technology and food production standards: (1) explore the ways in

which to increase productive forces and reduce the destructive forces of bamboo shoot production and processing technologies, (2) examine how state and non-state actors perceive and value these technologies to achieve ecological (e.g. chemical fertilisers' reduction) and economic (e.g. increase productivities) objectives. Contextualising bottom-up views of resource users' on how to utilize the productive forces of technology and minimize its destructive force can broaden debates in environmental governance and provide insights on how the contemporary Chinese understand technology at the local level.

Current research on bamboo in China mainly focuses on the economic values, model simulation, forestry management, taxonomy, poverty reduction initiatives, and policy implications of the bamboo production (Fu and Banik, 1996; Kant and Chiu, 2001; Pérez et al*.,* 1999 and 2004; Zhu, 2005; Zhong et al*.,* 1996). Commentators not only realise the potentials of bamboo to provide versatile of ecological services (e.g. carbon sequestration and soil stabilization and rejuvenation) and economic benefits (e.g. effective poverty reduction) but also helps China to reach sustainable development by employing both state involvement and market forces to reconstruct the bamboo production industry (Yiping et al., 2012; Marsh and Yang, 2008; Pérez et al*.,* 1999, Guomo, et al., 2013).

In terms of state involvement, commentators identify four major policy niches for the State Forestry Administration to achieve the sustainable development of the bamboo production industry including minimizing regional competition and uneven development between coastal and central-western part of China, facilitating industrial restructuring and integration, propelling technological innovations and extensions, and accelerating forestland reforms to tackle the problems of small landholding (Hu and Hui, 2002; Li et al., 2005; Yang, 2012). Commentators who appeal to market forces to restructure the bamboo industry

suggest that decentralisation of Central State policies, increase state public funding for the bamboo industry, adopt regional planning to increase agglomeration of bamboo resources, increase product standardisation and branding development, address the value-added processes and value-chains of bamboo resources are the ways to sustain the economic growth of the bamboo industry (Zhu, 2001; Xu, 2005; Xu et al., 2008; Shen, 2005).

Although the above studies provide a generic and macro understanding of how the state and market instruments promote sustainable development in the bamboo industry in China, they ignore the following three major considerations: first, most studies focus on economic value creation and strong role of the state to achieve sustainable development; they ignore the critical assessment of environmental impacts, perceptions of non-state actors, and policy failures under the rapid growth of the bamboo industry; second, most studies ignore how local state manage bamboo resources and collaborate with non-state actors to grapple with rural poverty, industry integration, knowledge production and production standards, and quality control. Third, most studies stress the institutional reforms to achieve sustainable development but they ignore the impacts of policies and market mechanism toward farmers and their living environment. The bamboo shoot production industry in Lin'an County provides a relevant case study to fill these three major gaps by questioning how the state and non-state actors govern the bamboo shoot production industry with state-centred and multi-nuclei governing structures and how the role of local state to produce a conducive environment for multiple actors to produce new knowledge, standards, and technology to achieve sustainable development.

Based on the literature review of current environmental governance debates and bamboo researches, an integrative research framework is devised to understand relational dynamics among the roles of state and market, technology

and governing capacities, humans and nature to achieve sustainable development at the local level. This analytical framework not only integrates the debates among advocates of ecological modernisation, eco-Marxism and political ecology but also examines China's environmental challenges within a situated local case study (see Figure 4)

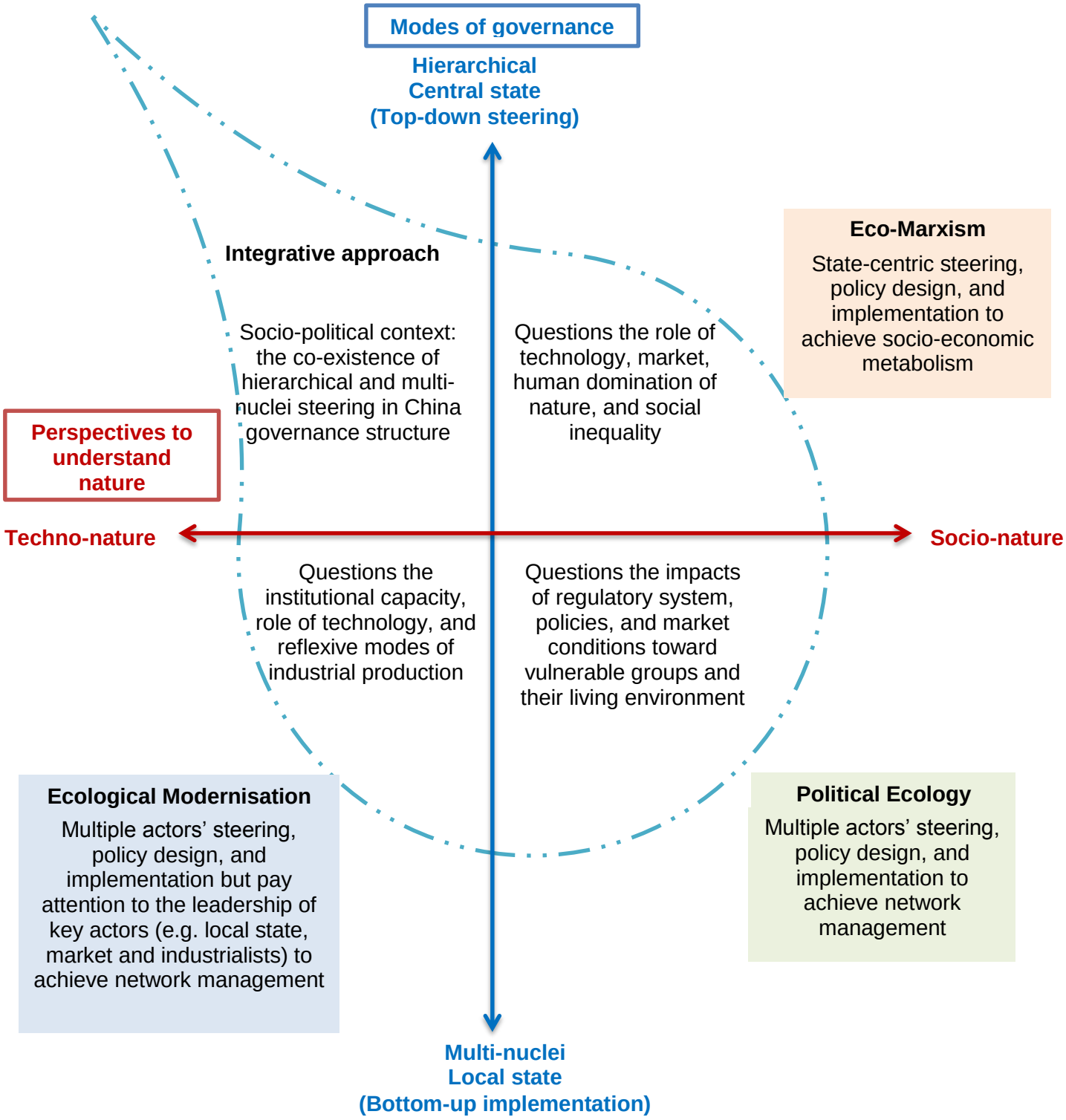


Figure 4 Research framework for governance and nature in China

2.4.4 Rationales to develop an integrative approach

This research utilises three major theoretical approaches - ecological modernisation, political ecology and eco-Marxism - and uses them as lenses to analyse China's local environmental governance in a specific time and context. These theoretical approaches provide different perspectives to address China's bamboo resource problems in a more holistic manner. For instance, ecological modernists focus on examining how institutional re-arrangement and the role of technology increase the capacities of the state from Central to provincial level to maintain economic growth and environmental risks. However, ecological modernisation may not effectively portray how farmers' and marginalised indigenous groups' perceive environmental changes at the county and township levels. To fill this gap, both eco-Marxism and political ecology provide a multi-scalar analysis to understand the interrelationships between the state (institutions) and environmental users by considering how privatisation of forestlands causes environmental degradation, social inequality and marginalisation.

Moreover, China's environmental changes demonstrate a unique and dynamic social-economic transformation, which is different from OECD countries. For instance, although China has not experienced industrial revolution like the OECD countries; however, China has experienced a rapid industrialisation and economic growth in the past 30 years (Shapiro, 2012). Lee et al. (2012) also argue that China's development is full of entanglements, conflicts and tensions. These include both conflicts between economic growth and environmental conservation, and contradictions arising from the legacy of collectivitism, and pro-growth market reform. If we want to understand the dynamism and contradictory tensions between economic growth and environmental conservation in the bamboo shoot production industry, then employing an integrative approach

allows the analysis of both positive and negative forces, which are shaping China's sustainable development. For instance, ecological modernisation theory helps to understand how the local state institutionalised bamboo shoot production standards and adopted cleaner technology in bamboo shoot production. However, both eco-Marxists and political ecologists offer insights into how the standardisation of bamboo shoot production is fragmented or confined to small groups of processors and producers. Furthermore, both eco-Marxism and political ecology help to see those negative forces, which affect sustainable development in Lin'an County including informalities, uneven distribution of economic benefits, and resource exploitation. In short, using an integrative approach allows a better explanation how different positive and negative forces come together to, shape sustainable development in China in a specific time and space.

Whilst it is possible to make a case for an integrative approach at a general level there are also reasons why it is particularly relevant for this study. First, bamboo is a natural product. How it is grown matters. Whilst ecological modernisation is relatively silent on nature it is central to political ecology thinking. Second, an important part of the dissertation is about understanding how supply chains and governance are co-constituted in Lin'an. In exploring the relationships between supply chains (where ecological modernisation is a valuable lens to apply to debates and data) and governance (where political ecology and eco-Marxism move to the fore as analytical lenses), the empirical material shows how together they are shaping environmental change. For example, Lin'an's local government will provide support for greater fertiliser use because of soil degradation and the need to meet growing customer demand for Lin'an bamboo shoot products. Third, ecological modernisation may not effectively understand farmers' and marginalised indigenous groups' perceptions on environmental changes at the county and township levels. However, both eco-Marxism and political ecology provide a multi-scalar analysis to understand the

interrelationships between the state (institutions) and the environmental users by considering how the privatisation of forestlands causes environmental degradation, social inequality and marginalisation.

At a methodological level, this research also adopts an integrative approach to collect quantitative and qualitative data to contribute to the debates among and between ecological modernisation, eco-Marxism and political ecology. For instance, the methodological approach of ecological modernisation led to the collection of data to understand how the role of the local state and market promote the institutionalisation of environmental rationality and practices. The data included policy documents, research reports, archival materials, the forest coverage rate of bamboo shoot production, and market transaction data sets (See table 2 pp. 81-83). Although eco-Marxism and political ecology shared similar methodological approaches with ecological modernisation; they stress qualitative approaches that include in-depth interviews to understand and compare state officials' and farmers 'perceptions of environmental degradation and social marginalisation in Lin'an County (See table 82-83). In Chapter Four, for example, taking an integrative approach initiates a discussion of the governance of forest resources and land organisation in Lin'an County (See section 4.4). On the one hand, this extends the theoretical debates on whether or not China under socialist Market reform - the shift from collectivism to market reform - reduces deforestation or reverts to unsustainable practices. On the other hand, this integrative approach addresses both the institutionalisation of environmental regulations (e.g. forest law) and implementation deficits of the local state (See pp. 162-163). In chapter Five, integrating the theoretical lenses from ecological modernisation, political ecology and eco-Marxism extends the discussion as to whether the local state in Lin'an can effectively to tackle the tension between environmental conservation and economic growth to achieve sustainable development (See the discussion on section 5.4, p.206-207). In

Chapter Six, using an integrative approach helps to expand the debates on whether using technology (e.g. early shooting and soil restoration technologies) and increasing governing capacity (production standards establishment) serves to re-orient farmers' unsustainable practices on bamboo shoot cultivation (See the discussion section on 6.4.3.pp.253-256). In Chapter Seven, employing an integrative approach contributes to the debates on whether land re-organisation, institutionalisation of processing standards and role of markets serve to sustain economic growth and mitigate environmental degradation (See the discussion section on 7.6 pp. 298-299).

2.5 Central research questions

Drawing upon questions of ecological modernisation, political ecology, and eco-Marxism on approaches of sustainable development (see Figure 4), this research critically develops Davidson's and Frickel's (2004) integrative approaches on environmental governance and Jordon's (2008) theoretical bridging between governance and sustainable development by crafting three major research questions (see below). These three major questions address how a local governance structure creates an environment for multiple actors to implement sustainable development policies. The Lin'an bamboo shoot production system provides a relevant case study to understand the Chinese lessons of how the state and non-state actors' interactions use bamboo shoot production and technology to achieve sustainable development.

The rationale for the first question is to understand how the state and non-state actors make decisions, designs and implements sustainable policies in the governance structure of the bamboo shoot production industry. There are four

major sub-questions to understand the steering approaches in the bamboo shoot governing mechanism including the interactions between state and non-state actors to make plans, policy design and programme implementation, establish standards, and the factors that affect governing capacities.

1. How do the state and non-state actors govern the bamboo shoot production industry?

- How do state and non-state actors make plans, deploy policies, and implement, Central State policies in both top-down hierarchical and network form of governing mechanisms?
- What are the major bamboo shoot policies and programmes?
- How are bamboo shoot market prices and production standards established and negotiated among producers, processors and market traders?
- What are the favourable and unfavourable factors that affect the governing capacities of the Lin'an bamboo shoot governance question

Apart from addressing the steering approach of the bamboo shoot governing mechanism, the rationale for the second question is to understand how the co-existence of the hierarchical and multi-nuclei governance structure implements bamboo shoot policies to achieve sustainable development. There are four major sub-questions to further understand the interactions of state and non-state actors in the hierarchical and network forms of governance structures including knowledge production, technology diffusion, standard making, trust making, gift-exchange, and negotiation.

2. **How do the co-existence of both state-centred and multi-nuclei governance structures have delivered sustainable development policies in the bamboo shoot production industry**?

- How are technological extension services and knowledge production reducing environmental impacts?
- What roles do state and non-state actors play in the institutionalization of 'hazard-free bamboo shoot production standards' through the co-operatives and processing networks?
- What are the embedded norms and values in the bamboo shoot production and processing system (e.g. trust-making, gift-exchange politics and negotiation)?
- How is technology used by state and non-state actors to co-produce both productive and destructive factors that affect the governing capacities of the Lin'an bamboo shoot governance system?

The rationale for the third question is to evaluate the effectiveness of local state policies to produce a conducive environment for multiple actors to use bamboo shoot resources to solve environmental and socio-economic problems. There are four major sub-questions to further address the perceptions and values of the state and non-states' actors on cultivating bamboo to solve ecological and socio-economic challenges, technological innovations, and market mechanisms.

3. **How does local state create an environment in which multiple actors struggle over low household incomes, environmental degradation, and integration of industry sectors?**

- How do local and non-state actors perceive, value, and make use of bamboo shoot resources to produce economic values and rejuvenate soil erosion?
- What are the local state policies to increase the industry's integration?

- How do farmers respond to the state's policies, technological innovations, and market mechanisms?
- What are those enabling factors (i.e. formal rules and regulations) and disabling factors (i.e. informalities) affect state and non-state actors to co-evolve with the bamboo nature to achieve sustainable development?

2.6 Conclusion

China's environmental challenges bring environmentalists, scholars, state agencies, and citizens together to consider how the role of state, market, technology, and bamboo material can help the Chinese society to achieve sustainable development. The Anglo-Saxon experiences in environmental governance become a global archetypical case to conceptualise the hollowing of the state shifting from government to governance involving civil society, private sectors, and the market to manage the environment. However, the Chinese environmental governance system demonstrates different features in decision making, steering approaches, and policy designs and implementations to govern the sustainable development. This is because China's governance structure demonstrates a co-existence between top-down hierarchical control and multiple actors' steering. To understand China's governance of sustainable development, this research takes an integrative approach to absorb the analytical strengths from ecological modernisation, eco-Marxism, and political ecology to consider the key decision makers, steering approach, policy design, and implementation to achieve sustainable development in China.

Taking an integrative approach, this research devises an analytical framework to contextualise: (1) how state and non-state actors grapple with low household incomes, environmental degradation, and ecological limits through bamboo shoot cultivation, (2) how the state-centred and multi-nuclei governing structure co-function to create new institutions, stipulate policies and projects to achieve synergy operation; (3) how the direct and indirect policy intervention of the state creates an incubating environment for multiple actors to produce new knowledge, standards, and industry integrations.

In the next chapter, this research will introduce the methodology and data collection activities to obtain relevant data to contextualise the governance of the sustainable development in the bamboo shoot production industry through the Lin'an case study.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The main objective of the fieldwork in rural China is to obtain quantitative and qualitative data to theorize the local dimension of the governance of sustainable development in Lin'an County. This research design is to collect data to understand major policy events and actors' interactions in the bamboo shoot production industry through collecting a survey in the first phase and generate preliminary themes for the second phase of qualitative research to conceptualise the steering approach, policy co-ordination, and implementation in the bamboo shoot production industry. Using both quantitative and qualitative approaches to answer three major research questions critically: How do the state and non-state actors govern the bamboo shoot production industry? How does the co-existence of both state-centred and multi-nuclei governance structures to promote sustainable development politics in the bamboo shoot production industries? How does the local state create an environment in which multiple actors struggle over low household incomes, environmental degradation, and integrations of industry sectors?

To answer the first research question, this research was conducted by a survey with farmers, collected policy documents, conducted in-depth interviews with state actors to understand the steering approach, policy delivery and implementation in land organisation, forest conservation, and bamboo shoot cultivation initiatives (see Table 2). To answer the second research question, this researcher addresses the agency and structure's interactions by conducting in-depth interviews with key state and non-state actors in the bamboo shoot governance structure (see Table 2). Document analysis is conducted to

understand how the local state implements forest laws, bamboo shoot production policies and programmes to propel the sustainable development of the bamboo shoot production industry (see Table 2).

To answer the third research question, this researcher collected the statistics from the Lin'an Forestry Bureau to describe the changes in household incomes, spatial distribution of the bamboo shoots, market prices, grading, and value-chains of the bamboo shoot production industry. Both quantitative and qualitative analyses were conducted to understand how state and non-state actors perceived the state's policies to solve low household incomes, and soil degradation and industry integration (see Table 2).

This research chose mixed method because of its "strength of drawing on both qualitative and quantitative research and minimising the limitations of both approaches" (Creswell, 2013, p.218). There are two major merits for this research; one was to adopt a mixed method and to understand the governance of the sustainable development in the bamboo shoot production industry. First, understanding the complex network of actors' interactions requires a holistic instrument to collect both quantitative and qualitative data to unravel the research questions. Second, quantitative data such as statistics can be compared with the qualitative data to explain the generalised patterns and regularities (Creswell, 2013).

This chapter is organised into five sections. Following the introduction, section two explains the reasons for studying the governance of sustainable development in the bamboo shoot industry in Lin'an County. Section three explains why and how the ontology and epistemology of realism help this research to conceptualise the governance structure and actors' interactions in the bamboo shoot production industry through ethnography and a case study approach. Section four elucidates the quantitative and qualitative data analysis of data in this research. Section five examines the challenges and coping strategies in data collection.

Table 2 Data and Methods to Answer Research Questions

Research questions	**Relevant data**	**Methods**
1. How the state and non-state actors govern the bamboo shoot production industry?	Steering approach – top down hierarchy and horizontal multiple actors' interactions - Collected policies documents in relation to land arrangement (e.g. forestland responsibility system, Three-Fixed Policy, Extension of forestland contract); farmers' co-operatives; dragon-head enterprises, industry's integration, production and processing standards, and the development of the bamboo shoot market. From centralisation to decentralisation in economic and environmental decision-making. - Collected policy documents from Lin'an Forestry Bureau, ZAFU's research reports, Bamboo Shoot Processors' Association's archival materials to understand the transition from centralisation to de-centralisation of state power, policy design, and implementation.	Conducted 56 surveys to understand farmers' responses toward these policies and conducted in-depth interviews with Lin'an Forestry Bureau officials and technicians, forestry experts, co-operatives' managers, demonstration farmers, bamboo shoot processors and market traders to their comments and opinions on the policy implementation of land organisation, production and processing industries, and market arrangement of the bamboo shoot production industry Conducted document analysis on Lin'an Forestry Bureau's forestland responsibility system to understand the process of decentralisation from Mao's communist period collectivisation (e.g. Land reform and People's Commune) to market reform (e.g. Forestland Responsibility System in 1978, Slope Land Conservation Programme in 1998, and the Extension of Forestland Responsibility System in 2003).

Research questions	Relevant data	Methods
2. How do the co-existence of both state-centred and multi-nuclei governance structures to promote sustainable development politics in the bamboo shoot production industries?	Addressed the agency and structure's interactions - Identified key state and non-state's actors in the bamboo shoot governance structure (e.g. Lin'an state and forestry bureau officials, demonstration households, bamboo shoot farmers, processors, and market traders, and co-operatives' leaders, bamboo shoot researchers and forestry experts). - Collected Lin'an bamboo shoot industry's legal documents, policies and programmes include land contracting policy since 1982, bamboo plantation supporting policy (1985-1988), six big six small bamboo shoot production policy (1991-1995), and 1518 programmes (1996-2000). Identified multi-nuclei governance structures - Addressed the emergence of new governance institutions under the	Conducted 43 semi-structured interviews with key state and non-state's actors to understand the delivery and implementation state's Five Year Planning (state-centric policy) in bamboo shoot production industry from the State Forestry Bureau to the Lin'an Country Forestry Bureau. Analyse the major policy events, programmes, and institutions to understand how state actors diffuse the new knowledge, technology, and standards in the production, processing, and market sectors. Then the political and socio-economic networks among state and non-state actors can be identified. Conducted document analysis on Lin'an by acquiring policy documents and reports from the Lin'an Forestry Bureau, the Zhejiang Agricultural and Forestry Department, Processor's Association and Lin'an Modern Technology Centre.

	economic decentralisation include farmers' co-operative, processor's association, and bamboo shoot markets. Collected data about the sustainable policies in the bamboo shoot production industry - Forestry transition from deforestation to afforestation (e.g. collected statistics from Lin'an Forestry Bureau's wood logging reduction (1982 to 2006), increase forest coverage rate (1982-2006), substitution woods with bamboo culms for firewood, and the statistics in relation to forest restructuring from 1982-2012). - To understand the governance of the economic prospect of the bamboo shoot industry. Statistics is acquired from the Lin'an Forestry Bureau's bamboo shoot production value from 1983 to 2012, processing industry's productivity from 1982 to 2012, market transaction data set 2009-2012.	Conducted semi-structured interviews with state and non-state's actors to examine how they evaluate the performances of policies in the bamboo shoot production industry to achieve sustainable development. Conducted questionnaires with farmers to understand their changes of socio-economic conditions after growing bamboo shoots, and their perceptions on using bamboo shoot to solve soil erosion, afforest the mountain, and to achieve sustainable development.

	- Collected data about the value-added process from bamboo shoot production, processing to marketing. - Collected data about the standards' making and technological diffusion in the bamboo shoot production industry	

Research questions	**Relevant data**	**Methods**
3. How does local state creates an environment in which multiple actors struggle over low household income, environmental degradation, and integration of industry sectors?	Understand how actual policies are implemented to solve low household income, environmental degradation, and increase industry's integration Collected the changes of household income data relation to bamboo shoot cultivation from the Lin'an Forestry Bureau - Lin'an Statistical Year Book (2002-2012) - Lin'an Forestry Bureau's statistics on bamboo shoot farmers' income data 1992-2012	Conducted document analysis and literature review on Lin'an's household income, environmental degradation and industry's integration Analysed the secondary data from the Forestry Bureau and triangulated the collected data from farmers' survey to understand their changes of socio-economic conditions after growing bamboo shoots Conducted semi-structured interviews with forest bureau officials, forestry experts, and demonstration

	Collected data about the environmental degradation of intensive bamboo shoot cultivation from the forestry bureau between 2000-2012 Collected data about the industry integration of bamboo shoot production - Collected the spatial distribution of bamboo shoot production segments - Collected the market prices, gradation system, value-chains, and importing countries of Lin'an bamboo shoots	households to understand the situations of soil degradation in Lin'an county. Conducted survey with bamboo shoot farmers to understand their perceptions on soil degradation Conducted semi-structured interviews with bamboo shoot producers, small inter-mediates, wholesalers, and transporters to understand their opinions on the industry's integration of the bamboo shoot production industry

3.1.1 Reasons to study the bamboo shoot industry in Lin'an County

This research selected Lin'an County, Zhejiang [2] province as the geographical focus to study the local governance of sustainable development because of three major factors: first, it has been known for bamboo knowledge and a long history of bamboo shoot production since the 15th century and Lin'an County is the biggest bamboo shoot production hub in China. Therefore, it provides relevant case studies to understand the governance of bamboo shoot production, processing and marketing; second, the local state uses bamboo widely as a means to manage soil erosion problems and stabilise farmers' livelihoods which provides a lens and empirical data to evaluate the steering approaches, policy implementation, and decision making of the local state; third, there are fruitful primary and secondary data available on the Lin'an's bamboo production industry which provide evidence to evaluate the ecological and socio-economic impacts of bamboo shoot production to achieve sustainable development.

There are three major reasons to study the bamboo shoot production industry: (1) Current bamboo shoot studies focus on statistical inference to descriptive analysis of the economic values, model simulation, forestry management, taxonomy, and trickling down effect of bamboo production in rural areas (Fu and Banik 1994; Pérez et al. 1999 and 2004; Zhong et al. 1996). These studies not only lack explanatory power to identify the causal mechanism between governance structure and actors' interactions but also lacunae in both literatures and approaches to understand how local state grapples with low household incomes, environmental degradation, and industry's integration

[2] The Zhejiang province is the largest bamboo production area in China located on the Eastern part of China, adjacent to the Shanghai Province. The administrative hierarchy of Zhejiang province is apportioned into 11 prefecture-level cities, 32 districts, 22 county-level cities, 35 counties and 1 autonomous county.

through bamboo shoot cultivation. (2) The bamboo shoot production industry is a crucial part of the mountain economy in Lin'an County (around 50 % of farmer's incomes is derived from bamboo shoots); however, there is scant research to assist in understanding farmers' perceptions, values and experiences of bamboo shoot production. (3) The distinction of bamboo as a multi-purpose crop; the bamboo shoot production is situated downstream from agricultural production and upstream for value-added processing and marketing. The whole industry relates to different agricultural and industrial sectors and directly affects hundreds of thousands of farmers' livelihoods. Understanding the local governance of bamboo shoot resources provides policy implications for other counties and provinces in China and other transitional economies.

3.1.2 Selection of field sites

Two field study visits to China were undertaken from August-September, 2011 and from June-December, 2012. These visits were used to collect primary and secondary data to answer the research questions. There were two major strategies in contact with gatekeepers in Lin'an county: first, participate in the International Network For Bamboo and Rattan's workshop in Anji and Lin'an County in 2011 to meet bamboo researchers and forestry experts; second, make contacts with gatekeepers in Lin'an County to prepare future field study research in the Taiwuyuen township and then apply for a research opportunity at the INBAR's Beijing headquarters in 2012. There were four main reasons for the selection of Taiwuyuen Township as the field site: (1) representation; (2) access; (3) collaboration opportunities and (4) geographical uniqueness of the field sites. These points are explained further below:

Bamboo shoot production is the major source of income for Lin'an farmers. In 2006, the bamboo shoot production industry produced 35,000 tons of bamboo shoots and generated a huge economic value of around 160 million Yuan. To select a representative field site, in 2012 the researcher spent two week travelling around Lin'an County and visited more than 20 administrative villages in *Taiwuyuen* Township with INBAR's officials and forestry experts. *Taiwuyuen* Township comprises 51 administrative villages with a total land area of 241.8 km^2. There are 28,000 mu (1866.7 hectares) of arable lands and 280,000 acres of woodlands; while bamboo production lands cover 13,000 mu (866.7 hectares) in which bamboo shoot cultivation lands accounted for 10 thousand mu (666.7 hectares) (Lin'an Forestry Bureau Forestry Statistics Database, 2012).

In terms of production, *Taiwuyuen* is the earliest township to grow early shooting *Ph. Praecox* bamboo shoots, it promotes hazard-free production standards, facilitates the county policies in land reform, industry's integration, and technological extension; these information are crucial for this research to contextualise the interactions of state and non-state actors in the bamboo shoot governance structure. In terms of processing, there are ten bamboo shoot processing firms (comprising both local led and small processors) located in the *Taiwuyuen* Township (see Figure 5) where processing comprises four major categories of bamboo shoot products[3] for internal and overseas markets. The vicinity of processing industries provides the opportunity for this study to conduct in-depth interviews with processors to understand the institutionalisation of production and processing standards, industry's integration, value-added processes, and the markets for the processed shoot products. In terms of marketing, the largest bamboo shoot market in China is located at *Taiwuyuen* Township, which offers pertinent information on the mechanism, scale of production, and price signals for the bamboo shoot market. More importantly, it

[3] These products include boiled canned shoots, dry bamboo shoots, preserved bamboo shoots and seasoning small package bamboo shoots.

provides an access to conduct surveys and in-depth interviews with producers, processors and market traders to understand their perceptions of the bamboo shoot market price signals, value-added processes, and unfavourable factors that affect the market mechanism.

Figure 5 Bamboo Shoot Processing Industries and Plantations
(Source: Author's collection)

Finally, this study selected two villages in *Taiwuyuen* township: *Bai Sha* village on a mountain-top and the *Xia Gao* village in a river valley to conduct surveys, in-depth interviews and ethnographic research (see Figure 6). These two villages are unique and different from other villages in Lin'an for three major reasons: first, both *Bai Sha* and *Xia Gao* villages are the field sites and training bases for INBAR's sustainable development training courses to promote a Chinese model of sustainable development for international scholars. Second,

the State Forestry Bureau designated the Bai Sha village as the forestry sustainable development model, and this has been promoted to other counties and provinces such as Hainan in China. Third, the Lin'an County designated these two villages as "eco-villages" and "Forest Science and Technology Demonstration Villages" for long-term ecological and socio-economic planning and development. This long-term planning provides prolific data and research materials to conceptualise the governance of sustainable development in Lin'an County.

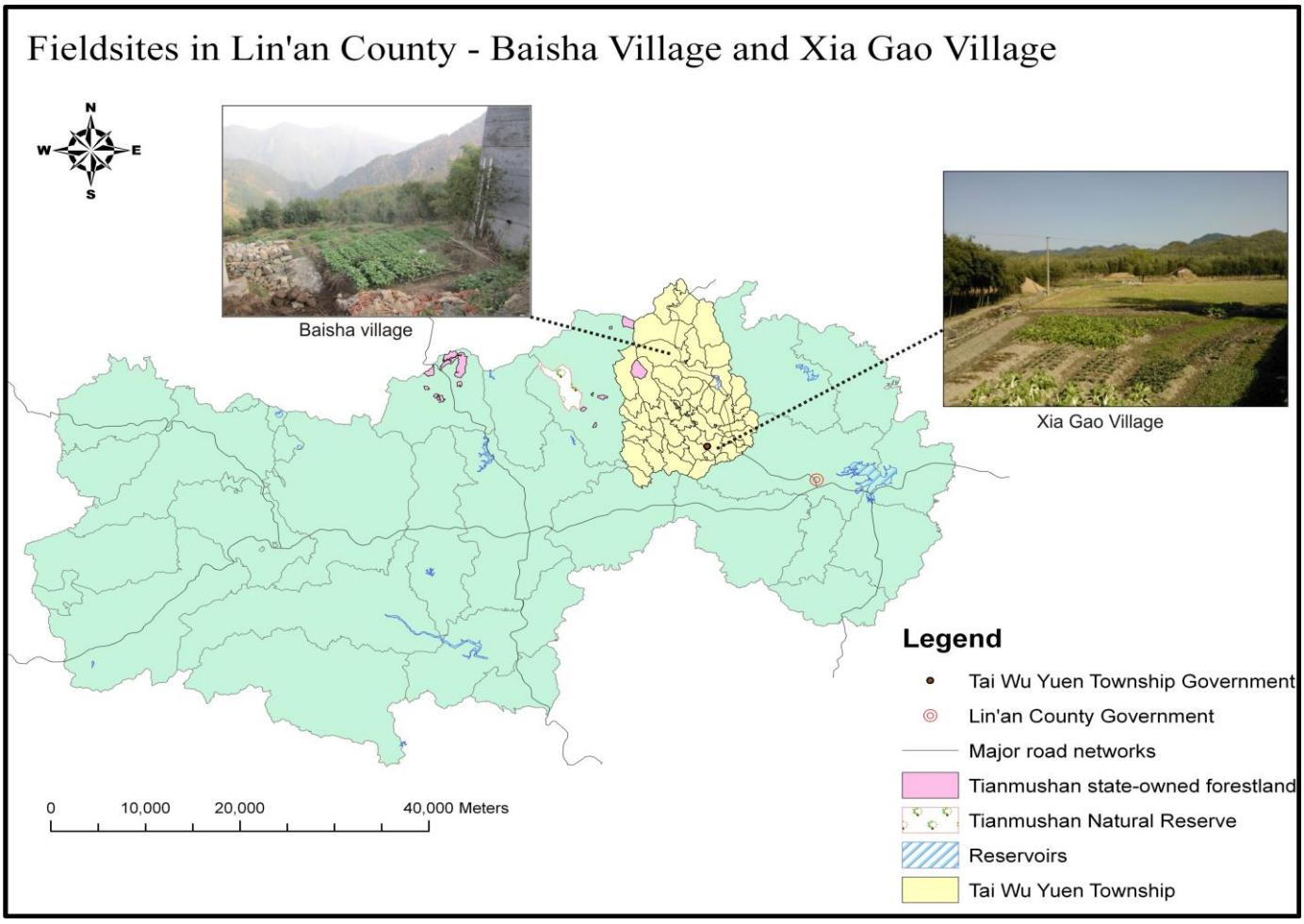


Figure 6 Field Sites in Lin'an County

3.1.3 Socio-economic features of bamboo shoot farmers

This research conducted a survey that is comprised of 66 questions (Appendix 5) with 56 farmers, in order to understand the socio-economic condition of bamboo shoot farmers in these two villages. Further analysis is undertaken below in 6 sections, including 1) age; 2) education level; 3) job nature; 4) family size, total size of farmland owned and perception; 5) total family annual income; and 6) duration of engagement in bamboo cultivation, reasons behind and employment of workers. Detailed information on number of farmers in each socio-economic feature is shown in Table 3.

Age

In this survey, 89% of the total farmers are male and 11% are female; 64.2% of them are older than 51 years old; while 35.85% of them age between 36 and 50.

This result shows there is an aging phenomenon in the bamboo production sector. One farmer commented, “The youngsters could not withstand the daunting tasks in bamboo shoot growing such as tilling soil, cutting and carrying the bamboo culms.” One farmer suggested that, “There is a necessity for the central government to re-collectivise the bamboo forestlands to stimulate the bamboo shoot production”.

Education level

Statistically, the education level of bamboo shoot farmers is enumerated as follows: 39. 3% of them received primary school education, 21.4% attended junior high school, and 17.9% obtained high school qualifications; however, no farmers obtained university level of education.

Task nature

Concerning the task nature of farmers, 75% of farmers mainly participate in agricultural activities and 25% of them are partially participating in both agricultural and non-agricultural activities. These non-agricultural activities include working in township village enterprises and the urban areas, and self-employed owners. In this survey, 26.8% of the farmers have been either ex- or current village cadres, while the rest have not participated in village level administrative works.

Family size, total size of farmland owned and perception

Concerning the family-size of farmers' households, 43% of interviewed households have 3 to 4 members and 32% have more than 6 family members. Regarding the total size of the farmland owned, the majority of farmers (51.8%) own less than 10 mu (0.6 hectare) of land and 21.4% of farmers own more than 10 mu to 20 mu (≥0.6-1.3 hectare) of land, while 26.8% of farmers own more than 20 mu (≥1.3 hectare) of land. Regarding the scale of bamboo shoot plantations, the majority of bamboo shoot farmers (64.3%) perceived that the sizes of the bamboo shoot plantation lands in Lin'an were very small, while 33.9% of farmers thought that their farmlands were greater than the medium size of the bamboo shoot production lands.

Total family annual income

Regarding the total family annual income, 41% farmer's households earn less than 50,000 Yuan annually, 46.4% of them make between 50,001 and 100,000 Yuan annually, 8.9% earn between 100,001 and 150,000 annually, and 3.6% earn 150,001 to 200,000 Yuan annually. Interestingly, 53.6% farmers perceive that their annual household income is above average and 46.4% think that they are below the average of Lin'an living standards. When asked about

sources of investment for their bamboo shoots' plantations, statistically, there are 47.2 % farmers who obtained their financial resources through their own savings and 45.5% of the farmers borrowed money from their relatives to invest in their bamboo shoot plantations; while 1.8% of farmers borrowed money from the credit union. There are no farmers who borrow money from banks or other sources.

Duration of engagement in bamboo cultivation, reasons behind and employment of workers

The majority of farmers (67.8%) have been cultivating bamboo for more than 16 years. This reflects farmers' incentive and dedication to the industry, as farmers also commented that they have the passion and artisan skills to cultivate bamboo shoots. In Lin'an, bamboo shoot cultivation is a place-specific agro-forestry practice with a long history of development. When asked about the reasons for growing bamboo shoots, the majority (57.5%) of farmers wanted to become wealthy through bamboo shoot cultivation, while 30% of farmers thought that bamboo shoot cultivation can help them to earn their daily bread. About 10% of farmers can earn a stable income from shoot cultivation and less than 2.5% of farmers think that there is no other better choice than bamboo shoot cultivation. During the bamboo shoots' harvesting period, the majority of farmers (72.5%) didn't employ any workers, while 21.6% of farmers employed one or two part-time workers and 7.8% of farmers employed more than three part-time workers.

Table 3 Number of Farmers in Xiao Gao and Bai Sha Villages in Various Socio-Economic Features

Gender	Male		Female	
	50		6	
Education level	Below primary school	Primary school	Junior high school	High School
	12	22	12	10
Task nature	Agricultural		Partially agricultural with non-agricultural	
	42		14	
Village cadres	Yes		No	
	15		41	
Family size	1-2 family members	3-4 family members	More than 5 family members	
	12	24	20	
Total size of farmland owned	<0.6 hectares	≥0.61 to 1.3 hectares	≥1.31 hectares	
	29	12	15	

Farmers' perceptions on their scale of production	Very small	Medium	Above medium	
	36	13	6	
Total Family annual income	≤ 50, 000 Yuan	50,001- 100,000 Yuan	100,001-150,000 Yuan	150,001-20,0000 Yuan
	23	26	5	2
Sources of investment	Personal income	Borrow from relatives	Borrow from credit union	Borrow from Bank
	26	25	1	0
Duration of engagement in planting bamboo shoots	≤10 years	11-15 years	≥16 years	
	6	12	38	
Reasons to grow bamboo shoots	Earn daily living	Get wealthier	Stable income	No other better choices
	12	23	4	1
Employment of workers during the harvesting period	0 workers	1-2 workers	≥3 workers	
	37	11	5	

3.1.4 Access

Before embarking on fieldwork in the Taiwuyun township, five major steps had to be undertaken to gain access to the field site: (1) provide a recommendation letter with a letter head from the Head of School for self-introduction (see Appendix 1); (2) present a Chinese version of the field research brief (*Kaocha Dagang*) (see Appendix 2) include the International Network of Bamboo and Rattan for the collaborative institutions (INBAR) (see Appendix 3), also Zhejiang University, Zhejiang Agricultural and Forestry University (ZAFU), Lin'an Modern Forestry Technology Service Centre (LMFTSC); (3) participate in relevant conferences and workshops to make contacts; (4) build a rapport with the key gatekeepers; and (5) obtain official permission from the Lin'an Forestry Bureau to conduct fieldwork (see Appendix 4). Steps 1 and 2 are crucial for gaining the trust of collaborative institutions; recommendation letter from the Head of School and a brief research proposal (In Chinese) (see Appendix 2) are essential to establish research collaboration with the International Network of Bamboo and Rattan (INBAR) (see Appendix 3), Zhejiang University, Zhejiang Agricultural and Forestry University (ZAFU), Lin'an Modern Forestry Technology Service Centre (LMFTSC). Once the collaborative institutions understood the research directions (*yinjiu silu*), they provided specific research assistance, recommended important contacts in the Lin'an Forestry Bureau, and offered relevant secondary data in relation to forest coverage, types of vegetation, and biomass in Lin'an County. To achieve steps 3 and 4, participating in bamboo and forestry training workshops in 2012 became a crucial means to make contacts (see Appendix 5), ask for access permission, and interview opportunities with the *Taiwuyuen* township government officials, village heads, bamboo shoot farmers, demonstration households, and bamboo researchers. To achieve step 5, there were two strategies undertaken: first, ask for a recommendation and invite the Lin'an Modern Forestry Technology Service Centre to arrange an official meeting

with the Vice Head of the Lin'an Forestry Bureau to discuss fieldwork in Taiwuyeun Township; second, present the field study's objectives, schedules, daily routines, and requested assistances to the deputy head during the meeting. Finally, the deputy head granted a verbal permission for this research to county field study in *Taiwuyuen* Township and at two villages: *Xia Gao* and *Bai Sha* villages.

3.1.5 Collaboration opportunities

Making formal and informal contacts are crucial to conducting fieldwork in China. Good contacts often provide a prerequisite for the collection of robust primary and secondary data in China. From the outset, this study depended on official approval from the Lin'an Forestry Bureau. With the official approval, the researcher arranged to stay in a bamboo garden located at the Xia Kao village in *Taiwuyuen* Township. For the first few days, there was one retired official who monitored and assisted the processes of fieldwork. This retired official persuaded and suggested to conduct field study in the bamboo garden by waiting for other farmers to conduct surveys. However, merely waiting at the bamboo garden and conducting surveys passively were not efficient to collect sufficient data to answer the research questions. To cope with this situation, there were three major strategies instigated to meet more farmers and other informants: first, collaborating with two farmers' co-operatives allowed this research to conduct surveys and interviews with their members. Farmers' co-operatives provided a favourable place to meet, chat and conduct interviews with bamboo shoot farmers. Second, establishing research collaboration with the Forestry Bureau's Technological Extension Services not only allowed this research to access relevant bamboo policy documents but also offered the opportunity for the researcher to accompany the forestry technician to visit their bamboo shoot

farmers. Third, making contacts with the Bamboo Shoot Processors' Association allowed this research to obtain the contact list of processing firms in *Taiwuyuen* Township and call the local-lead and small processors for an interview. More importantly, the Bamboo Shoot Processor's Association provided the statistics of the productivities, production values, processing firm's production cost, production and processing standards, and processed bamboo shoot's product segments.

3.1.6 Geographical uniqueness

Taiwuyuen is a mountainous township. This research considered the geographical variations among the types of bamboo shoot growing, daily practices, socio-economic conditions, physical landscapes, norms and regulations which are different between the villages in the mountain-top and the nearby river valley when selecting two villages for detailed analysis. Living with farmers in Bai Sha Village (Lung Shu Shan section) and Xiao Gao Village helped this research to have a better understanding of the embedded norms and values in the bamboo shoot production system (e.g. trust-making, gift-exchange politics and price negotiation). In addition, selecting two villages in one case study (further discussed in section 3.3) was a pragmatic approach to conduct ethnographic and case study analyses in rural China. Heimer (2006, p.72) commented, "a one case study with multi-field-site approaches is appropriate for studying a phenomenon in depth, to uncover general mechanisms and to generate new empirical findings."

The ontology and epistemology of realism is a research belief to guide the research assumptions of design, design, and procedures to conceptualise the governance structure and actors' interactions in the bamboo shoot production industry. According to Creswell (2009) philosophical worldview influences

researcher's designs and procedures; this is important to understand how a researcher makes claims, collects data and evidence to shape knowledge, and explains the causal relationships between actors and social structure. This research is influenced by realism and assumed that there is a range of actors interacting in the bamboo shoot governance structure.

3.2 Framework and methodological design

3.2.1 Realism

Realism is defined as "the world is largely independent from what we observe" (Sayer, 2006, p.98). It is a "belief in an external world which exits and acts independently of our knowledge" (Gregory, 2009, p.261). Simply, realism understands the world is stratified and distinguished which exists independently of our knowledge. Realism points out that actors' interactions are constituted by events, mechanisms, and governance structures. To understand the knowledge of actors' interaction in the governance of the bamboo shoot production industry, realism provides three major theoretical insights for this research to understand the causal relationships between actors' interactions and governance structure.

First, the realism perspective helps this research to conceptualise the governance structure and actors' interactions in the bamboo shoot production industry. According to Sayer, (1992, p.97) governance structure is "historically specified which are sets of internally related objects or practices". Within a particular structure, there is a specific role[4] and status, which may be constructed and reconstructed by state and non-state actors. Gregory (2009, p.622) explains

[4] Specific roles are refer to different position imply different roles. For instance, the position of Professor attributes more power and ability in the classroom. However, the position of student is relatively weaker roles than a professor.

that a governance structure is “made up of networks of internal relationships and defined positions to be occupied by actions”. Regarding the concept of actor, Sayer (1992, p.96) defines this as an individual who has power to emancipate and transform structures. Sayer (1992) understands the co-existence of actors and governance structures as necessary conditions to produce the steering approach, policy and programmes, and governing mechanism. This is because both the individual actor and governance structure are mutually shaping each other. On the one hand, a governance structure enables state and non-state actors to interact and communicate with one another. On the other hand, state and non-state actors have reflexive thoughts, which can transform the governance structure by using their practical skills such as knowledge, discourse productions and communication tactics (Bhaskar, 2008; Sayer, 1992; Danermark et al*.,* 2002).

Second, employing a realism perspective helps this research to realise the causal relationship between actors and the governance structure. Sayer (1992) argues that there are particular causal relationships among policy events, state and non-state actors, and governance structures. Cloke et al. (1991, p.148) explains that there are both contingent and necessary relationships between actors and governance structures. First, there is a necessary relationship in which the relation cannot exist without the other. For instance, the necessary relationship between rural collectives and bamboo shoot farmers in Lin’an is because the former is the landowner; the latter is the tenant (see Figure 7). There is an interdependent relationship between landowner and tenant. However, there is contingent relation in which the first event must occur in order for the second to exist or to happen by chance. For instance, there are different contingent conditions, which affect the necessary relationship between the rural collectives and bamboo shoot farmers in forestland arrangements; these contingent conditions include the local context of governing institutions, steering

approaches, and policy preferences for centralisation or decentralisation processes (see Figure 7).

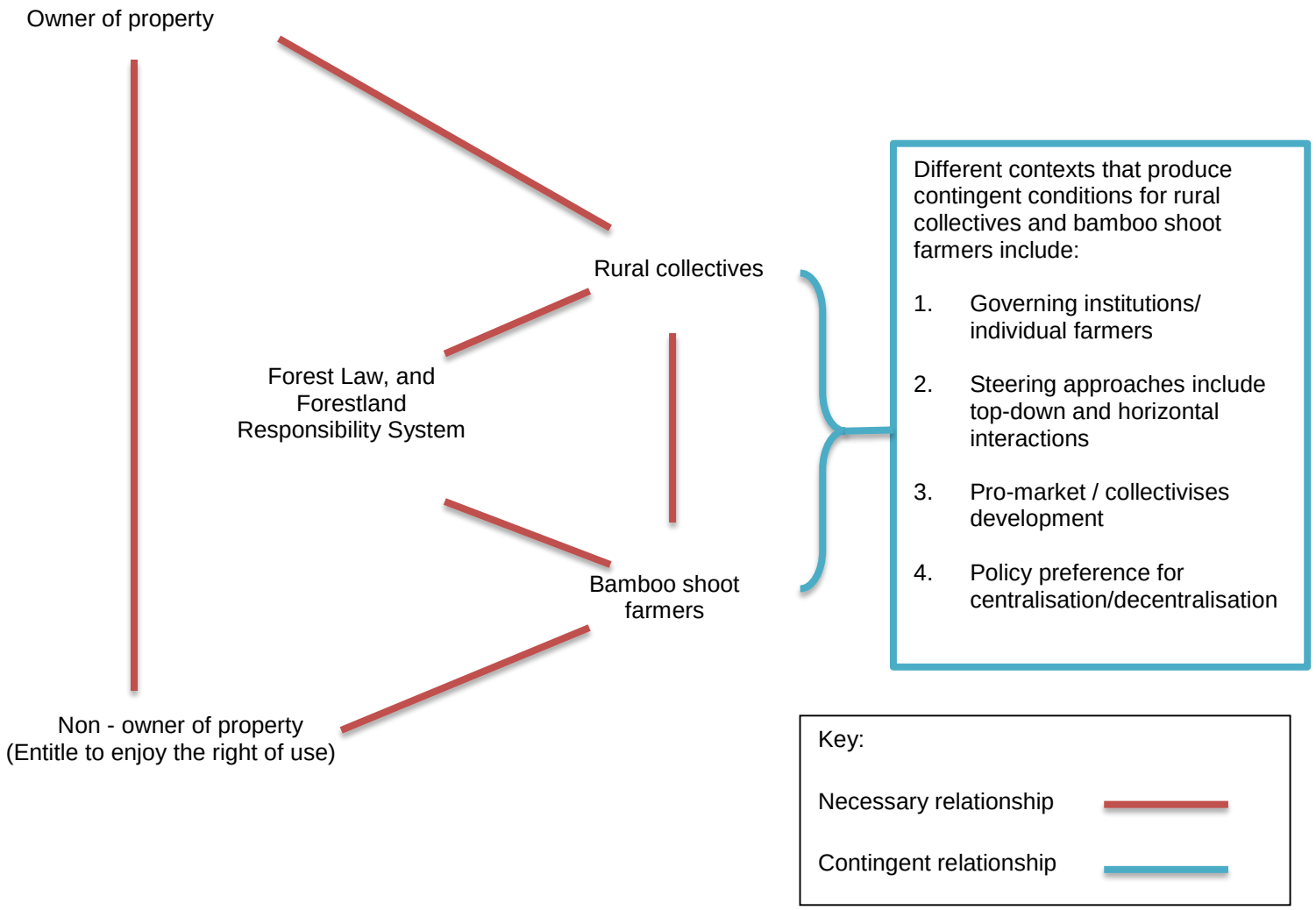


Figure 7 Necessary and Contingent Forestland Relationships
(Source: Sayer, 1992, p.93)

Third, harnessing a realism perspective helped this research to understand the actual policy events, concrete governance programmes, and the abstract knowledge of governance structures through “extensive” and “intensive” research. According to Sayer (1992) and Danermark et al., (2002), there are

complementary roles between intensive and extensive research studies. “Extensive research” addresses the similarity, dissimilarity, and correlation in the actual social world by generating regular events and patterned social phenomenon through the quantitative method (e.g. survey). For example, conducting a survey with bamboo shoot farmers to quantify their descriptive perceptions of the changes to forest coverage to understand the phenomenon of afforestation. The generalisation of the phenomenon of afforestation needs further studies (e.g. intensive research) to understand the causal relationships between forestry programmes and actors’ interactions in order to explain the why and how of the changes of forest coverage. Cloke et al. (1991) further illustrates that “extensive research” adopts questionnaires, surveys, and statistical inferences to identify the similar patterns and regularities from a large number of cases. Rather, “intensive research” looks at the abstract causal relationship, structural, and substantial mechanism with the goal of understanding the values, norms, embedded conventions among actors’ interactions within the governance structure (Sayer, 1992). Therefore, employing “intensive research” is to identify the causal process in a small number of cases and adopt qualitative methods including in-depth interviews and ethnography to identify specific contingent and necessary relationships in the bamboo shoot governance structure (Cloke et al., 1991).

Regarding realist epistemology, both extensive research (e.g. quantitative survey) and intensive research (qualitative methods of ethnography and case-study approach) have applied to understand the interactions between actors and governance structures (Gregory, 2009; Sayer, 1992; Danermark et al, 2002). The following section will discuss the qualitative methods of ethnography, and the case study approach and forms of data collection which include surveys and in-depth interviews.

3.2.2 Ethnography

This study harnesses ethnography to contextualise the local dimension of governance of sustainable development in rural China because it is both a process and an outcome to provide a (1) stronger base of empirical observation on state and non-state actors' interactions in steering approaches, decision making, policy delivery and implementation (see Figure 8); (2) better understanding on the perceptions, values, and norms of non-state's actors on land arrangement, production standards, state's policies, bamboo nature, and bamboo resource management in actors' daily contexts (Goldbart and Hustler, 2005; Hammersley and Atkinson, 2003).

Figure 8 Participant Observations in Rural Committee Meeting in Bai Sha (Source: Author's collection)

Pioneering scholarly effort in ethnography began in the early 20th century. Anthropologists such as Boas, Malinowski, Radcliffe-Brown, and Mead obtained first-hand information on primitive societies. This information included the shared and learned patterns of values, behaviours, beliefs and language of a culture-sharing group. This method highlights the reciprocity between researcher and participants. For instance, Steward (1972) tried to understand how cultural changes were initiated by human adaptation to the environment and he coined the phrase "cultural ecology" to understand how cultures are changed under adaptation to the environment. Rapport (1984) studied the Tsembaga tribesmen in the New Guinea highlands by examining how the dynamic relationship between the number of pigs, role of the pig festival (Kaiko festival) and warfare affected the population and land capacity. Until the mid-20th century anthropologists, influenced by Marxism, post-structuralism, and discourse analysis, theorised on how peoples' livelihoods, diverged from environmental and cultural determinism[5], which claimed that climatic and cultural factors influenced civilizations. As the determinists' approach naturalized the domination of powerful groups and justified the process of depoliticisation (Robbins, 2004, p.19), anthropologists combined political economy approaches with ethnographical studies to open up opportunities for research on opaque actors such as farmers (Scott, 2008) and yielded more research on colonial and post-colonial systems (Smart, 1992), gender and politics (Lee, 1998; Yang, 1994), environmental justice (Escobar, 2008), and marginalised groups in transitional economies (Gladney, 1991; Hansen, 1999).

In current environmental ethnographical studies, researchers ask questions about the imbalanced power relationships, access to resources, and gender suppression in environmental degradation, and risks (Checker, 2007;

[5] Environmental determinism refers to environmental factors that determine the superiority and inferiority of the races groups, while cultural determinism refers to how the more civilised ethnic group should dominate the less civilised group.

Tsing, 2005). Recent development in environmental ethnography also appeals researchers to speak out for environmental victims in society. For instance, Tilt (2010, pp. 16-17) tellingly reviews two major theoretical trends in ethnographical studies concerning environmental victims: (1) green research agenda and (2) brown research agenda. For the green research agenda, anthropologists are concerned about how environmental programmes under the names of environmental protection or harbouring biodiversity, which marginalise the traditional values and practices of local people. Lowe (2006) questions the top-down views of Indonesian scientists by espousing knowledge of conservation biology to transform the archipelago off the cost of Sulawesi into a national park; however, local Togean people hold different views on the conservation project and their local knowledge on conservation and nature is rooted in a traditional indigenous knowledge in contrast to that of the Indonesian scientists. Agrawal (2005) theorises the interactions between governing technologies and the production of environmental subjects in Kumaon's forestry during the British colonial rule in the 1920s. He coined the term "environmentality" which harnessed a Foucauldian approach with extensive ethnographical studies to examine how power, governing institutions, discourse and subjectivities interact in environmental politics. For a brown research agenda, anthropologists study how industrialisation produces health problems and environmental risks on marginalised groups. For instance, Tilt (2010) conducted an ethnographic study in the south-western part of Sichuan in China to understand how local people experienced air and water pollution from the nearby zinc smelter and coal washing plant. Wainwright (2013) conducted the first ethnographic account of rural Sichuan to examine how residents understand cancer.

By learning from environmental ethnographical studies, this research adopts an ethnographic approach to acquire socio-economic data and first-hand information about the governance of the bamboo shoot production industry in Lin'an through fieldwork (see Figure 9).

Figure 9 Day-to-Day Activities with Bamboo Shoot Farmers
(Source: Author's collection)

Surveys and in-depth interviews were the major ethnographic methods of data collection used to understand how state and non-state actors govern the bamboo shoot production industry to achieve sustainable development. There are three major directions to obtain relevant ethnographic data: first, acquire data about how state and non-state actors make plans, co-ordinate to deploy resources, implement bamboo shoot policies to manage the governing institutions and policies through document analysis, conduct in-depth interviews with key actors; and conducting surveys with bamboo shoot farmers; second,

obtain data about how the state and non-state interact in both top-down and horizontal multi-nuclei governing structure to co-ordinate and implement policies in industry integration, technological extension and knowledge production, standard-making and quality control in the bamboo shoot production industry. This data can be obtained from County's Five Year Plan documents, Lin'an Forestry Bureau's bamboo shoot programmes and proposals, and policy documents. Third, conducting in-depth interviews with state officials, forestry experts, demonstration households, bamboo shoot farmers, processors and market traders to understand how state and non-state actors establish market prices to increase market efficiency, increase education and training to increase bamboo resource's utilization to increase the sustainable development of the industry. These three directions of data collection are crucial to answer three major research questions by conceptualizing how the state and non-state governs the bamboo shoot production industry to achieve sustainable development.

In the view of Agar (1980) and England (1994), there are some challenges for researchers when conducting ethnographic research including researcher bias, time-consuming data collection, and misinterpretation between researcher and informant. In this research, first, conducting ethnographic research in mountainous Lin'an was time-consuming because of poor accessibility and transportation. To overcome the accessibility problem, three major solutions were used: first, consulting the staffs in the Lin'an Modern Forestry Technology Service Centre for daily travel planning and scheduling could utilise the time more effectively for field research. Calling informants one day before the day to conduct in-depth interview or survey was a way to make sure informants were available for conducting interviews. Second, asking farmers to provide a free ride via motorcycle if this was possible. Mostly, Lin'an farmers were happy to provide a free ride to the researcher. Third, the last resort was to hire a private van to reach the farmers; price negotiation with the drivers at the village entrance was a

crucial practice to make sure the hour rate was low and avoid any re-negotiation at the destination.

Second, farmers in Lin'an County may speak Lin'an dialect when they shared sensitive information includes the information about the government's corruption practices and neighbourhood conflicts. To resolve this problem, learning how to listen their dialects and interpret their body language were important strategies to understanding their comments and opinions. Additionally, inviting farmers to teach some basic pronunciation of the Lin'an dialect or asking farmers to translate their core ideas in Mandarin were the main ways to solve language barriers.

3.2.3 Case-study approach

This research adopts a single-case study of the governance of bamboo shoot industry to understand how the local state and non-state actors' steering approach, policy co-ordination, delivery, and implementation in forestland organisation, production standards' institutionalisation, industry's integration, knowledge production and technological diffusion. The major reason to adopt a single case study is to conceptualise the local governance of sustainable development through understanding the causal relationships between actors' interaction and governance structure to enable the formation of policy events and mechanism. These causal relationships include the decentralisation of economic and environmental decisions open up new governance structures (co-existence of the top-down and multi-nuclei) and increase room for non-state actors to participate in policy co-ordination, delivery, and implementation in the bamboo shoot industry (Sayer, 1992; Yin, 1989, p. 47).

This research adopts a single-case study design because the bamboo shoot industry as a whole is a case study. In the view of Flyvbjerg (2006, p. 235), single case study research is a powerful means to “generate ideas and evidence” which “can be linked in many ways”. Within the single case of the bamboo shoot industry, there are four major subunits of empirical analysis to be linked in the conceptualisation of the local governance of sustainable development: (1) governing land organisation; (2) governing structures, policies, and programmes; (3) governing bamboo shoot production; and (4) governing bamboo shoot processing and marketing. These four subunits provide chances for “extensive analysis, enhancing the insights into the single case” (Yin, 1989, p. 52). Additionally, Eckstein (1975) suggests three major categories of case study: (1) configurative-idiographic studies which is a descriptive method to reflect the chain effects of the single event; (2) disciplined-configurative studies which are used to interpret a group of events in order to search for patterns; (3) heuristic case studies are the method to stimulate researchers’ thoughts in order to imagine plausible theoretical solutions. This research sees the bamboo shoot production industry as a “heuristic” case study to tackle the theoretical issues arising from the conflicting roles of the state in environmental restoration/degradation and economic growth/challenge to achieve sustainable development in China. In this research, conducting a survey and in-depth interviews are two major forms of data collection within an ethnography and the case study approach. The objectives, design, processes, and challenges of conducting a survey and in-depth interviews will be discussed below.

3.2.4 External validity

With a single case study research approach, it is important to recognise the potential wider implications of the findings but also to identify the limits to generalising the findings. In considering how generalisable the Lin’an bamboo

shoot production case study might be across different geographical locations, social settings and time in China attention must be given to external validity (Creswell, 2011, p. 120-121) The generalisability of the Lin'an County case study depends on drawing the correct inferences from other places' bamboo shoot types, governance subcultures, role of the local state, and pro-growth policies (Creswell 2009, p.190-192). Based on these criteria, the findings from the Lin'an case study would also be relevant to bamboo shoot cultivation in the Western and South-Eastern parts of China as they grow similar types of bamboo shoots (e.g. Ph. Praecox and Moso bamboo shoots), adopt top-down governance structures and pro-growth policy strategies.

3.2.5 Survey

The survey was conducted with 56 bamboo shoot farmers. There are 66 questions in this survey and they were used to explore farmers' demographic information and perceptions of major government policies in the bamboo shoot production industry. There are three objectives of this survey: (1) provide a voice for farmers' accounts of policy implementation and its consequences, (2) address how farmers perceive land arrangements, technological extension and knowledge production, the market system and price mechanisms, and (3) evaluate how farmers perceive bamboo nature and the use of early shooting techniques to increase productivity.

There were three major steps to prepare questions in the survey: first, taking reference from existing surveys in Liang (2012)'s *Payment Schemes for Forest Ecosystem Services in China: Policy, practice and Performance* and Guo and Zhang (2010)'s *China Co-operatives Survey* to prepare the survey' questions in relation to forestland responsibility system, slope land conservation scheme, co-

operatives' policies, production standards' establishments, and the price negotiation with the processors. The survey design was divided into 8 sections: Section 1 and 2 are descriptive questions in relation to bamboo shoot farmers' background information, for example; How old are you? What is your gender? (see questions 1 to 23 in Appendix 5), section 3 and 4 are multiple-choice questions in relation to farmers' perceptions on marketing conditions of bamboo shoots and the development of farmers' co-operatives; what do you think about the bamboo shoot market price? (e.g. a. very stable, b. stable, c. often stable, d. fluctuating, e. very fluctuating) (see questions 24 to 35 in Appendix 5). Section 5 is designed to understand farmers' perceptions on the implementation of the Forestland Responsibility System (1978-1998) and the Extension of Land Contract in 2003; both closed and open-ended questions were asked. The closed-ended questions were multiple-choice questions for farmers to choose from. For instance, before the implementation of the Forestland Responsibility System did you perceive forest? 1. All forest resources belonged to the people's communes, 2. Farmers should follow the commands and quotas assigned by the communes, 3. Forest resource sold below market prices, 4. Forest was served for the purpose of communist modernisation and economic development). For open-ended question, for question 41 asked, "What do you think about the programme for eliminating barren hills to achieve green water and mountain? Please explain your reasons (see questions 36 to 52 in Appendix 5). Section 6, 7 and 8 were to understand how farmers perceived bamboo shoot cultivations, government subsidies, and participation opportunities in government policy making (see questions 53 to 66 in Appendix 5).

Second, in September 2012 establishing one meeting with the authors include Dr. Liang Dian at the State Forestry Bureau office in Beijing and Prof. Gao at the Zhejiang University in Hangzhou respectively to comment on the drafted questions in the survey. Both Dr. Liang and Prof. Gao provided suggestions to fine-tune the questionnaire's questions to fulfil interviewees'

knowledge background and answer the research questions, particularly the format that the questions asked and wordings that were being used to fit in farmers' education background. The remedial measures to tackle this gap are to design the type, techniques, and wording of interviews carefully. For example, the interview design should be semi-structured rather than too formal because of farmers' knowledge background; the vocabulary should be easily understood rather than using "jargon".

Additionally, conducting a pilot study with 5 bamboo shoot farmers on 15-9-2012 to test the effectiveness of the survey instrument and questions had been modified according to the responses and comments of the test participants. There were two major problems; first, farmers felt less confidence to answer inferential questions first and they needed time to warm up before answering difficult questions. To solve this problem, the sequences of questioning was re-arranged; descriptive questions were asked first including the basic information of farmers and daily bamboo shoot production activities (see survey structure in Appendix 5) with the goal of increasing famers' confidence to conduct the survey. Second, farmers found the survey's questions were difficult to follow. The remedial strategies were to group the survey question six major themes in a chronological order, which helped farmers to understand the questions. For instance, grouping the land related issues into the theme of land arrangement, which gave farmers a general direction of the questions being asked. Then, asking the survey's questions according to a chronological order and made it easier for farmers easier to remember their experiences on land related issues. For instance, asking farmers' perceptions of the land conflicts after the implementation of the 1978 Forestland Responsibility System first; then the next question asked, "Were there any land conflicts after the 2003 Extension of The Forestland Contract?" More importantly, reading out the questions helped farmers feel that they were having a conversation with the researcher. Farmers

felt more comfortable to answer the questions if the researcher read out the survey questions.

After the pilot study, the survey's structure was modified and finalised into seven major themes (see Appendix 5): Part one investigates general demographic information on bamboo farmers; part two examines the perceptions of farmers on the effectiveness of the slope land conservation programme and logging ban; part three unravels how farmers perceive the forestland arrangement and land conflicts; part four evaluates the efficiency of the technological extension services; part 5 addresses the values farmers place on co-operative policies; part six highlights how farmers perceive the bamboo shoot markets and production standards; and part seven asks how farmers value bamboo nature.

There are two major reasons why the survey questions are tightly structured. First, it established a platform to help informants to provide relevant and insightful responses. This was because based on the feedback from the pilot survey farmers found it easier to talk if a survey question is well-structured. Second, the structuring of the questions inspired informants to provide further explanations of their responses. For instance, a survey question asked informants to choose which types of support farmers wanted from the state with five choices: (1) financial, (2) technical, (3) land contracting, (4) marketing, and (5) environmental degradation. If a farmer choose answer (1) financial; then this prompted a further question "why do you choose financial support?".

The survey was conducted between 15-9-2012 and 15-10-2012 in Xiao Kao and Bai Sha villages at *Taiwuyuen* Township in Lin'an County. In this period, 70 farmers were approached and 56 farmers agreed to complete the survey questionnaire; a response rate of 80%. Each questionnaire survey took around 30 to 45 minutes to complete (see Figure 10).

Figure 10 Conducting a Survey in One Bamboo Shoot Farmer's Home

The survey contains both close and open-ended questions, which allows more flexibility in the way in which questions are asked and answered (Denzin and Lincoln, 2005). For instance, the closed questions provided explicit options for farmers to choose from including multiple choices and short answers to quantify farmers' socio-economic conditions; open-ended questions allow farmers to express their perceptions, values, and experiences on a particular topic such as the policy performances of the state on land arrangement, farmer's co-operatives, technological extension, and forest conservation (see Table 4).

Owing to geographical constraints, scattered population and limited field study period in a mountainous Lin'an county, snowball sampling method[6] or chain referral method was used to conduct survey for two major reasons: first, snowball sampling is a method for identifying more opportunities to meet more farmers by "taking advantage of the social networks of identified respondents to provide the researcher with an ever-expanding set of potential contacts" (Atkinson and Flint 2001, p.2). Neuman (2007, p.144) and Peterson (2013, p.72) further explain that snowball sampling make direct or indirect linkages between research and informants, "this does not mean that each person directly knows, interacts with, or is influenced by every other person in the network. Rather it means that, taken as a whole, they are within an interconnected web of linkages" (Neuman 2007, p.144).

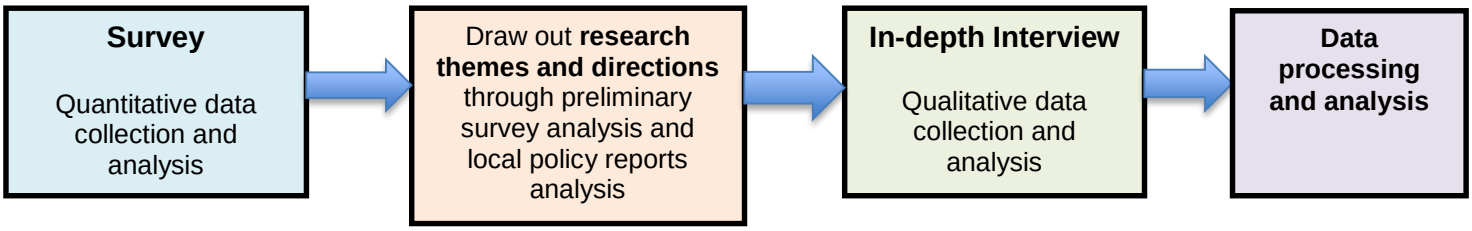
There are two major ways to recruit survey participants through snowball sampling method: first, depending on the social network of surveyed farmers in the Xiao Kao and Bai Sha villages; the researcher based on the information and referrals provided by previous surveyed farmers to expand the set of potential contacts for further surveys. It begins with one farmer and spreads out on the basis of links to other famers through their personal linkages and friendships. After the survey was conducted, the researcher would invite the surveyed farmers to recommend other farmers for conducting surveys. The snowball sampling method was very helpful for the researcher to conduct surveys with farmers because of the efficiency to locate potential farmers to conduct survey and effectiveness to gain access to the village communities. However, the major methodological challenge of the snowball sampling is the representation of the data. Since snowballing sampling is not randomly sampled, it may include biased selection and excluded informants from the existing social networks being accessed. Three major strategies were used to minimise the representation

6 This process is similar to a process of snowball formation, which start with a small snowball but becomes larger as it keep rolling and picking up new snow.

problem of the data collection through snowball sampling: first, sufficient planning in terms of survey design, objective, and conducting processes were needed to increase the sources and qualities of collected data. Second, develop parallel snowball sampling networks in two separate villages in order to increase the data representation by enlarging the data sources. Third, increase the source of data collection by inviting staffs in the Lin'an Modern Forestry Technology Service Centre introduced member farmers from Bai Sha and Xiao Gao villages for conducting surveys. When farmers were interested in participating in conducting survey, the researcher would conduct survey at the service centre or visit farmers' houses in these two villages.

To understand the complex network of actors' interactions in Lin'an bamboo shoot governance structure requires both quantitative and qualitative data collections. Conducting survey is the first phase of data collection and it generates preliminary results to build on the second phase of qualitative research. By drawing the generalised patterns and regularities from the survey, this provides emerging themes for conducting in-depth interviews and follow-up data collection in the second phase (see Table 4).

Table 4 Flow of conducting surveys and in-depth interviews



1. Descriptive questions

- Farmer's personal information and socio-economic data

2. Inferential questions

- Multiple questions and open-ended questions to understand farmers' perceptions on

  a) market conditions, farmer's co-operative development,

  b) land organisation,

  c) bamboo shoot cultivations,

  d) government subsidies, and

  e) participation opportunities in government policy making

1. Drawing patterns and regularities from key questions in the survey

- For instance, the majority of farmers believe that bamboo cultivation reduce logging

2. Conduct document analysis' on local policy reports

- Key policy reports include Jiang's (2008) Sustainable Forest Management and Indicator in Lin'an; The Zhejiang Forestry Product Competitiveness (Xu, 2006); and Zhu's Sustainable Participatory Forestry in China (1997)

3. Talking to retired officials and demonstration households to improve the in-depth interview questions

8 major themes were covered: (1) the governance of land arrangement, (2) institutionalisation of standards, (3) industry integration, (4) actors' integration and co-ordination, (5) utilise the functions of bamboo to solve socio-economic and ecological problems, (6) new technology and knowledge diffusion,(7) market development, and (8) participation channels

1. Descriptive questions

- Describe the land arrangement conditions after the implementation of the Forestland Responsibility System in 1982 and Extension of Forestland Contracts in 2003?

2. Structural questions

- What were the progresses of the standardisation of hazard-free standard, particularly pesticides and fertilisers' usages in Lin'an County?

3. Contrast questions

- Comparing the differences in land arrangement before and after the implementation of the 1978 Forestland Responsibility System

Triangulation and crosschecking between quantitative and qualitative data

Quantitative

- MS Excel
- Charts and graphs

Qualitative

- Coding
- Document analysis

3.2.6 In-depth interviews

43 In-depth interviews were conducted with key state and non-state actors between 15-10-2012 and 15-12-2012. Each interview took more than 60 minutes and prior to conduct in-depth interviews; informed consents were obtained from informants (see Appendix 6). The objectives and purposes of the collected data would be presented to informants. State actors included 1 State Forestry Administration official, 4 forestry bureau officials and 1 Science and Technology Bureau's official, 2 technological extension technicians, 2 bamboo forest experts from the Research Institute of Subtropical Forestry (Zhejiang) and 2 researchers from INBAR, 2 researchers from Zhejiang University, and 2 researchers from the Zhejiang Agricultural and Forestry University were accepted to conduct in-depth interviews. Non-state actors include 13 demonstration farmers, 8 bamboo shoot processors, 4 market traders, 2 farmers' co-operatives' managers were interviewed (see Appendix 7).

In-depth interview questions are semi-structured in order to increase the flexibility in the ways in which questions are asked and answered (Denzin and Lincoln, 2005). There were 34 questions and three major types of research questions asked concurrently in the depth interviews: (1) descriptive, (2) structural, and (3) contrast questions (Neuman, 2007, p.298). In-depth interviews covering eight major themes: (1) perceptions of the forestland responsibility system and land arrangement in 1982 and 2003, (2) institutionalisation of production and processing standards; (3) industry's integration; (4) policy implementation and co-ordination; (5) effectiveness of using bamboo to fix ecological problems and create economic potentials; (6) perception of new technology and knowledge diffusion; (7) perception of bamboo shoot market development and marketing strategies; and (8) perception of the availability of citizen participation channels (see appendix 7).

For state actors, the descriptive question is used to identify major policies events and actors in the governance of the bamboo shoot production industry. For example, “describe the land arrangement conditions after the implementation of the Forestland Responsibility System in 1982 and Extension of Forestland Contracts in 2003?”; “describe how the Slope land Conservation Programme in 1984 affected the agro-forestry in Lin’an County?”; “What are the major policies strategies to stabilise the fluctuated market prices?”; “why Lin’an County needs to establish bamboo shoot production base?” After asking the state actors to describe the major policies in the bamboo shoot production, processing, and marketing sectors, structural questions are asked to understand the steering processes, policy-ordination and delivery to achieve sustainable development in the industry. For instance, “can you comment about the progress of standardisation of hazard-free standard, particularly pesticides and fertilisers’ usages in Lin’an County?” “Could the extension of the land contract increase the sustainable development of the bamboo shoot industry?” These structural questions help the in-depth interview to discuss and ask further questions related to factors and forces, which propel the process of standardisation and land reform. For instance, “Could you evaluate what are the major factors to propel the process of standardisation in Lin’an County such as consumer’s demand, market price, local state’s leadership, farmers’ ideological change, and the restructuring of the industry?”; “Evaluate how the extension of the land contracts transformed the forestland landscapes and farmers’ incentive in bamboo shoot cultivation?” For contrast questions, this research asked questions to understand the changing modes of governance and decentralisation process from state-centred to multi-nuclei governance structures. For instance, what were the differences in land arrangement before and after the implementation of the 1978 Forestland Responsibility System? What were the difference in terms of production and qualities before and after the institutionalisation of the hazard-free production standards?

There were three major challenges for conducting in-depth interviews with state actors: first, to access the state actors, particularly state officials was difficult in China; it took time to negotiate with the gatekeepers and asking for referral to meet state officials; second; state officials might not be willing to answer all of the questions. To cope with the first challenge, inform the research objectives and progresses to the gatekeepers honestly and listened to their comments carefully was important to earn their trust for referrals. Second, to cope with the quality to conduct in-depth interview with state officials; trying to repeat the questions kindly after the official had provided his/her answer and ask him/her again to provide further thoughts for the question. Additionally, talking to retired officials to crosscheck the state official's comments by saying, "Mr. Y said that the County government didn't allow farmers to grow bamboo shoots on the farmlands, had you heard about any story?" This crosschecking method could testify the validity of the state official's comments and opinions and increase the quality of collected data.

There were four major steps for recruiting state actors to conduct in-depth interviews: first, working as a research intern at the International Network of Bamboo and Rattan in Beijing provided opportunity for the researcher to contact the Lin'an Forestry Bureau's and State Forestry Administration's officials. For instance, Professor Zhu Zhao Hua from INBAR recommended the researcher to help in the sustainable bamboo production training workshop in Lin'an County and to help him to establish an informal meeting with one retired official from the Lin'an Forestry Bureau. Second, after the meeting, this retired official helped the researcher call the Deputy Head of the Forestry Bureau to set up the first in-depth interview with the Forestry Bureau's officials. Third, a detailed research proposal with research questions was presented to the Deputy Head of the Forestry Bureau before conducting the in-depth interview. Fourth, after the interview the researcher asked the deputy head of the Forestry Bureau to further conduct in-depth interviews with other officials and technicians in the Forestry

Bureau. Finally, the researcher could now conduct in-depth interview with officials in the Technological Extension Department, Bamboo Shoot Processor's Association Department, and Forest Seedling Department. Additionally, the researcher also invited one senior-level expert from the Technological Extension Department to provide referrals to conduct in-depth interviews with the Science and Technology Bureau's official and researchers in the Research Institute of Subtropical Forestry (Zhejiang) Zhejiang University, and the Zhejiang Agricultural and Forestry University.

For non-state actors, the descriptive questions were used to understand the background contexts of informants. For example, these questions included, "how long have you been practicing bamboo shoot cultivation/ processing/ marketing"?; "Have you participated in farmers' co-operatives/ processors' association"?; "How long have you been cultivating/ processing bamboo shoots?' After learning about the background information of farmers/ processors/ traders, structural questions were asked to inform about specific policy events (e.g. Forestland Responsibility System policy), state's environmental programmes (e.g. Slope Land Conservation Programme) and particular environmental concepts (e.g. sustainable development, early-shooting technology, and hazard-free production standards). For instance, these questions included "how has early shooting technology affected your production?" "How has the establishment of the bamboo shoot market influenced your income level?" "Would you please comment on the implementation of the hazard-free production standards in Lin'an"? For contrast questions, the researcher asked questions to find similarities and differences between policy events, programmes, and environmental concepts. These questions included, "What were the differences between the implementation of the forestland responsibility system in 1982 and extension of the forestland contract in 2003 in Lin'an"?; and "What were the similarities and differences between the concepts of circular economy, sustainable development, and scientific development?"

To recruit non-state actors to participate in the in-depth interviews, three approaches were integrated: (1) invite farmers to have an in-depth interview after the participation in the survey; (2) invite the bamboo shoot association to provide contact information for bamboo shoot processors' contacts. The researcher gathered processors' contacts and called them to discuss the purpose of my research and ask for an in-depth interview opportunity; (3) work with the Forestry Bureau technicians and ask them to recommend the researcher to demonstration households, farmers' co-operatives and other government officials; the researcher built trust with the forestry technicians by following them on their village visits. After building rapport and trust with the forestry technicians, they were able to provide referrals for the researcher to meet the demonstration households.

There were two major challenges for conducting in-depth interviews with non-state actors: first, it was more challenging to contact bamboo shoot processors because they always said, "I have to travel and please call me later", or "I am not interested in academic issues, sorry". To deal with these challenges, the researcher asked the contact person in the Bamboo Shoot Processor's Association to provide a members' contact list (including the contact person and phone number) and asked for his endorsement to call the Association's members; once the researcher obtained the contact list; cold calling method was used to reach potential processors for in-depth interviews by saying, "Mr. X, the contact person of the Processor's association, suggested this researcher call you for an in-depth interview concerning how bamboo shoot processors propelled the whole industry's development and your comments would be important for the sustainable development of the industry in long-term. Would you please give me some time to conduct an in-depth interview?" With the support and endorsement from the Processor's Association, the researcher could meet 8 bamboo shoot processors to conduct in-depth interviews. For the second challenge, there was difficulty in understanding value-added processes from the market traders'

perspectives because market traders tried to keep their profit margins and skill values a secret. To cope with this challenge, asking the demonstration households and bamboo shoot farmers to crosscheck with the traders' comments can fill in the information gap of the value-added process and profit margin of market traders.

Field notes were used to document the conversation with state and non-state actors for analysis. This requires a high oral proficiency in Mandarin because the "Chinese field is characterised by a strong focus on the necessity of proficient language skills and contextual knowledge in order to do qualified academic work" (Sœther 2007, p. 45). The researcher is fluent in speaking and listening to Mandarin, which provided the necessary language proficiency to understand the social and cultural contexts in the research site.

3.3 Data processing and analysis

Data availability, reliability, and feasibility were considered in three major ways: (1) research networks were well-developed with the Central State and local state forestry bureaus, research centres, and International Network of Bamboo and Rattan (INBAR), (2) well-established databases have been identified (e.g. China's longitudinal bamboo forest coverage database in INBAR and longitudinal bamboo shoot productivities, market information, and forest coverage change database in Lin'an Forestry Bureau) and a crosschecking method was used to compare the validity among these databases, (3) surveys and in-depth interview questions were carefully devised; a pilot study had been conducted prior to a full survey to check that informants provided high quality data to fulfil the research objectives, and the quantitative and qualitative data which was coded and analysed. According to Creswell (2013, p.201)

triangulation is a process to examine evidences from different data sources and use it to build a coherent justification for themes. If themes are established based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study." Using multiple types of primary data (survey, ethnographic, and in-depth interview) had been triangulated with secondary data from the Forestry Bureau, and Lin'an Alamance to develop major policy events (see Appendix 8). Research themes included the policy co-ordination and implementation in land organisation, bamboo shoot knowledge production and standards' making, and bamboo shoot processing and marketing. Additionally, peer review and member checking were used to validate the quality of the data and research outputs in three major ways: first, the author provided detailed half-year field reports, quarterly research progress reports and monthly research outputs for the research committee members to comment and review; second, the findings of chapters four and five had been presented in both departmental and international conferences for member checking. Living with farmers for more than five months provided a prolonged engagement opportunity to collect both primary (survey and in-depth interviews) and secondary data (e.g. collecting the Forestry Bureau's statistics) in Lin'an County.

3.3.1 Quantitative analysis

For quantitative analysis, both macro-statistical data and micro-statistical survey data were used for analysis. This includes government census data, like Lin'an Statistical Yearbooks from 1990-2012 that are published by Editorial Committee for Almanacs of Lin'an County and available on China Knowledge Resource Integrated Database (2013), the data set of the annual bamboo production value and productivity between 1982 and 2012 from the Lin'an Forestry Bureau, processing industry's productivity, exportation quantity of

bamboo shoots, and transaction values between 1982 and 2012. This data set was for the three consecutive years of market transaction values and quantities. In Lin'an's two largest bamboo shoot markets (2009 to 2012) the farmers' annual incomes (1992-2012) and forest coverage changes data (1982-2012) were collected by the Forestry Bureau. These data was crucial in order to establish a database to examine bamboo shoot farmers' socio-economic conditions, longitudinal forest transition, and provide the macro data to understand the governance of the bamboo shoot industry. For instance, the researcher also gathered forestry data from the Almanacs in Lin'an, Lin'an Forestry Bureau's five year development blueprint for forestry policy (e.g. 135 Lin'an Forestry Planning document), and academic reports from the Zhejiang Agricultural and Forestry University (e.g. The Zhejiang Forestry Product Competitiveness report) and the Research Institute of Subtropical Forestry (Zhejiang). Geographical information data was obtained from the Forestry Bureau and was used to visualise the geographical conditions of Lin'an County. For instance, this research obtained the Lin'an Forestry GIS maps in 2009 from Lin'an Forestry Bureau to visualise the geographical characteristics of Lin'an County.

To interpret the micro-survey data, a baseline study had been conducted through a survey; there were two stages of data analysis. For the first stage, preliminary analysis of the major trends and patterns of the collected survey data from Xia Gao and Bai Sha villages to generate themes to design in-depth interview questions. The data was coded and recorded in Microsoft Excel.

The second stage of data analysis was conducted when the researcher returned to Cardiff, read through interview notes, categorised and classified the most descriptive wordings into eight major themes from analysing the perceptions of farmers on (1) bamboo nature, (2) forestland responsibility system, (3) slope land conservation, (4) economic value creation in bamboo production and processing, (5) bamboo shoot production standards, (6) production limits and constraints, (7) conflicts and system constraints, and (8) participation in policy making. With the help of categorization, these findings of this research

were reported with Microsoft Word and produced tables, figures, and maps through the Microsoft Excel respectively. After analyzing the quantitative data, this research then analyses the qualitative data from in-depth interviews and policy documents.

3.3.2 Qualitative analysis

For qualitative data, document analysis is used. There are two main benefits to adopting document analysis: First, written materials “provide a broad picture” for understanding Chinese institutional mechanisms and triangulate the local state’s documents with crucial policy events to identify “contradictory facts” (Heimer 2006, pp.67-68). For instance, this research collected Lin’an Forestry Bureau policy documents, Zhejiang Agricultural and Forestry’s Universities academic reports, and Bamboo Shoot Processor Associations’ monthly reports – Bamboo Information (1985-2001 No.1 to No.152). These documents provided supporting ideas and evidence that helped this research to contextualise the institutional structure, practices, and dynamics between major state and non-state actors in the Lin’an bamboo shoot governing system. Second, document analysis provided an understanding of how the knowledge of environmental programmes (e.g. Forestland Conservation and Slope Land Conservation Programmes) were constructed in “policy papers, academic work and media reports socially, legally and economically” (Svernsson, 2006, p.262). The textual accounts from the government documents were compared with the oral sources and farmers’ comments to provide a more holistic picture about the governance of the bamboo shoot production industry. Since the researcher had written short notes during the interviews and expended notes after each interview; this was helpful for the researcher to go back to transcribe necessary quotes from the tape recordings conversations. Conversations in the interviews were coded into

nine categories: C for co-operatives, D for demonstration households, E for forest experts, F for bamboo shoot farmers, G for government officials (include forestry bureau officials and technicians), I for INBAR's officials, M for market traders and intermediaries, P for bamboo shoot processors, N for NGOs. All cited quotes and conversations were transcribed and this transcribing process involved repeated listening, specific data session streaming, and typical case or quotes' selections (see Appendix 9).

3.4 Challenges and coping strategies

Conducting fieldwork in China is not only an eye-opening learning process but also full of challenges and frustrations (Thøgersen and Heimer, 2006 p.1). Commentators reflect the frustrations to access the right informants and interpret the official and unofficial use of the Chinese language and question the quality of data collected in China (O' Brien and Li; 2006; Thøgersen, 2006; and Gustafsson and Li, 2006). Different scholars handle these challenges and frustrations differently; some scholars work out their own coping strategies and collaboration plans with Chinese research institutions to solve the challenges in data collection; others conduct fieldworks which are similar to a guerilla type of data collection in both officially approved and unofficial approved arenas (Yeh, 2006). Indeed, the condition to conduct fieldwork is full of dynamics with case-to-case subjects depending on the researchers' locations, academic positions and gatekeepers' helpfulness. The following section will discuss the role of the researcher in the field sites, the challenges encountered and coping strategies adopted during data collection.

Considering the role of a researcher, this researcher harnesses three major values: First, be reflexive toward the researcher's role in data collection because it is important to maximise the wellbeing of the informants. Prior to conducting fieldwork in China, getting ethical approval from the School (see Appendix 10) and receiving sound training with versatile research skills in human geography were crucial to conducting reflexive fieldwork in China. For instance, between 2009 and 2014, the researcher acquired comprehensive quantitative and qualitative research trainings with a breadth of research methods at the University of Calgary (MA level) and Cardiff University (PhD level) (e.g. this involved questionnaires and in-depth interviews with different stakeholders and combined archival and ethnographic methods to obtain thick empirical data).

Second, be critical of the information provided by the State's agencies and INBAR's officials because state officials may produce priori judgements that bamboo production is always positive to Lin'an County's ecology and socio-economic development. As a critical researcher, crosschecking between the state's official data with farmers' perceptions toward the state's policies can maintain critical thinking and avoid research bias. Additionally, be critical in the issue of researcher identity because informants (particularly, state officials) were curious why do I received doctoral training in the United Kingdom and came to rural China to conduct field study. Local state officials and bamboo shoot farmers understood the researchers' identities differently. For instance, one of the gatekeepers in Lin'an County introduced the researcher to the state officials as a foreigner who was born and received education in the United Kingdom. Some informants called the researcher as "Hong Kong student" and even called him as a "reporter" from Hong Kong. On the question of reading the identity, the researcher on the one hand kept his identity as a researcher; on the other hand allowed local informants to decide what they believed and understood were the ways to protect their best interests. However, honesty, integrity, and research

ethics are always important values to be maintained during the entire research project.

Third, harm and risks for the research participants should take precedence over the research objectives. This researcher evaluated the potential harm and benefits toward informants. For instance, considering the privacy and confidentiality of informants' information in order to protect their safety and wellbeing. Pseudonyms and changes in characteristics such as the location of bamboo shoot plantations were used to maintain privacy and confidentiality in this research. Following fieldwork, all notes, transcriptions, audiotapes, jottings, diagrams and maps were kept within a filing cabinet in a locked office. Computer files, recordings, and other electronic documentations were password protected. Additionally, building up a reciprocal relationship was a crucial means to maintain equal power relationship with informants prior to recruiting informants to participate in the survey and in-depth interviews; the researcher provided the purpose of the project, the end use of data, and obtained informed consent from the informants.

There are five major challenges in data collection: First, living in a mountainous such as Lin'an County is not an easy task because of poor transportation. Planning the field study schedule carefully was the effective way to cope with this issue. A snowball sampling method was adopted to maximize the interview opportunities. This meant asking farmers to refer other farmers to participate in both the survey and in-depth interviews. This method not only helped to increase the efficiency of conducting the survey but also reduced the travelling and time cost during the data collection.

Second, there was co-existence of collaboration and monitoring from the state actors in the field study. Maintaining honesty and following the rules established by the gatekeepers were the ways to cope with this issue. For

instance, the researcher maintained honesty and integrity by explaining the research objectives and methodologies clearly for the INBAR and Lin'an Forestry Bureau officials. In order to gain access to Lin'an County, getting the referral from the INBAR's official to meet a retired official from the Lin'an Forestry Bureau was an important step to establish research collaboration. However, after finishing all the fieldwork in the Lin'an County, the researcher had to return to INBAR's headquarter in Beijing to report his preliminary research findings and ways to write up an academic report. There is research censorship and monitoring from the state actors.

Third, the presence of power-play among state actors in terms of symbolic and hierarchical power; the researcher had to be careful to observe the body languages and conservations among state officials in order to avoid conflicting with the state actors' interests. Facing the power play among state actors, and developing a reciprocal relationship with state officials were coping strategies, which means an equal or symmetrical power relationship is preferred. For instance, evaluate the potential harm and benefits between different interests groups and pay attention to the moral and ethical concerns. Ethical consideration allowed researchers to develop a more symmetrical power-relationship with the state actors and build trust with gatekeepers. Before conducting surveys and in-depth interviews, obtaining informed consent from state officials was the priority. More importantly, protecting the privacy and confidentiality of state officials' information by giving pseudonyms if they were referenced or quoted in my thesis is essential.

Fourth, the presence of benefits and gift exchange relationships between state and non-state actors produced ethical challenges. To cope with implicit norms and gift-exchange cultures, it was important to maintain an ethical standpoint by declining any gift exchange activities. For example, one time, an official asked, "If I provide any assistance for your fieldwork here, could you

provide free accommodation and dinner for my family when we travel to Hong Kong?" The offer was kindly declined and it was explained that according to the School's laws it was not possible to provide any financial benefits.

Fifth, the issue of pesticides in the bamboo shoot production industry is not explored for three major reasons. First, there is limited field data to be obtained because this project focuses mainly on examining the interrelationships between fertiliser usages and soil degradation. Second, owing to time constraints, time on fieldwork concentrated on data collection related to the research questions. Thirdly, it was difficult to obtain pesticide data from the Agricultural Bureau in Lin'an County because it is more sensitive than obtaining fertiliser data from the Forestry Bureau.

3.5 Conclusion

This chapter introduces both quantitative and qualitative methods to theorise the local dimension of the governance of sustainable development in Lin'an County by collecting survey data in the first phase and generate preliminary themes for the second phase of qualitative research to conceptualise the steering approach, policy co-ordination, and implementation in the bamboo shoot production industry.

By adopting both quantitative and qualitative approaches, three major research questions are critically addressed with relevant data: How do the state and non-state actors govern the bamboo shoot production industry? How does the co-existence of both state-centred and multi-nuclei governance structures promote sustainable development policies in the bamboo shoot production industries? How does local state create an environment in which multiple actors

struggle over low household income, environmental degradation, and integration of industry sectors?

The findings of these questions are presented in the following four chapters: Chapter four elucidates how local state driven the decentralisation of economic rights, and institutionalisation of forestlands' contract to rejuvenate soil erosion and increase farmers' economic incentives through bamboo shoot cultivation. The form of governance in the early reform period is characterised in state-led decision-making, high level of supervision, and vertical bureaucratic relationships with non-state actors. There are policy gaps between policy design and implementation of the land contracting system, which caused inefficiency in land arrangement and farmers' conflicts on their boundaries of forestlands. Chapters Five, Six and Seven illustrates how the local state and non-state actors tackle the conflicts between economic growth and environmental degradation through increasing capitalisation and value-added process in the bamboo shoot production industry through knowledge production, innovation, and economic partnerships. The local state acts as a shepherd who still upholds power and authority but it shows a tendency to increase economic flexibility and autonomy for non-state actors to participate in production standardisation, new institutions, and increased industry integration.

CHAPTER FOUR: GOVERNING FORESTLAND ORGANISATION

4.1 Introduction

This chapter analyses the forestland arrangement and major forest programmes in Lin'an County, from communism to market reform, to understand the approaches to resource allocation, policy delivery, and decision making, which illustrates a shift from state-centric government to the co-existence of a hierarchical and multi-nuclei form of governance to achieve sustainable development. This chapter highlights how the Lin'an state after the 1978 reform period employs both administrative means and economic measures to de-collectivise land ownership and means of production from the hands of people's communes to individual farmers to grow bamboo shoots. There are two major arguments of this chapter: first, the re-organisation of land arrangement provided more rights, responsibilities, and economic benefits for farmers to make production decisions, with the Lin'an state recruiting farmers to participate in bamboo shoot cultivation through economic incentives and administrative measures. Second, although there is an observable tendency of the Lin'an state to institutionalise forestland contracts, and classify, and marketise forest resources, the governance of land organisation to achieve sustainable development has encountered two major challenges: (1) an over-dependence on growing bamboo shoots to solve economic and soil erosion problems has ignored the attention on the biodiversity and monoculture problems; (2) there are gaps between policy design and the implementation of the land contracting system in Lin'an. On the one hand, smallholding of land caused low productivity. On the other hand, the ambiguity of the forestland boundaries not only induced farmer conflicts but also caused inefficiencies in land adjustments with conflicts left unsolved.

This chapter is divided into five sections. Following the introduction, section two analyses the deforestation and afforestation programmes from communism to market reform to understand the ways of resource management, policy delivery, and decision making in bamboo shoot production. Section three stresses how the Lin'an state contracted out forestlands and means of productions from the hands of people's communes to individual farmers under the Forestland Responsibility System (FRS). After this, the Lin'an state adopted both administrative measures (e.g. policy directives, technological extension, and demonstration households) and economic measures (price incentives and market values) to encourage farmers to grow bamboo shoots to solve socio-economic problem and tackle soil erosion on barren hillsides in Lin'an County. Section four employs the integrative perspectives from ecological modernisation, political ecology, and eco-Marxism to evaluate both opportunity and challenges in the governance of land organisation to address sustainable development in Lin'an. Section five is the conclusion of this chapter.

4.2 Forest governance during the communal period in Lin'an County

Since the establishment of the People's Republic of China (PRC) in 1945, Lin'an County has undergone different forms of resource allocation and policy delivery from Maoist communism to reformist marketisation. The former emphasised collectivised resource procurement[7] and unified marketing[8] and the latter stressed de-collectivisation and used the market mechanism in resource allocation (see Table 5).

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[7] According to Li (1995, p. 450) collectivised resource procurement (also called *tong gou bao xiao*) was where the state government had "exclusive right to purchase the industrial goods that are [were] vital to national planning and people's livelihood….and the prices and standards are [were] pre-determined by the state".

[8] According to Li (1995, p. 451) was a policy of centralised purchase and unified marketing (also known as *tong gou tong xiao*) aimed at "controlling the supplies of major agricultural products" to stabilise market prices and safeguard people's livelihoods.

Table 5 Changes in Forestland Arrangement and Resource Allocation

Periods	Major Political directives in Lin'an	Forestland arrangements	Resource allocation and decision making	Social and Environmental Impacts
1949-1952	Land reform	Farmers are both owner and user of forestland and forest resources	Farmers enjoyed the right of use, right to derive income, and right to sell their forestlands. Farmer made their own farming and marketing decisions.	Tenant farmers freed from landlords' exploitation and entitled to have land ownership. Increased agro-forestry productivity. However, increased population and demands on firewood accelerated the forest depletion. The communist party penetrate the village levels and control the socio-economic aspects of farmers.
1953-1957	Farmers' co-operative	Farmers are both owners and users of land and tree tenure but they had to share their labour, equipment, draft animals and work tasks with other farmers in the co-operatives.	The co-operative unified individual farmers' rights of use of their forestlands to implement production and harvesting plans collectively. Unequal transactions between rural forestry products and urban commodities.	Co-operatives were established to organise and recruit farmers to plant trees. Farmers lost their right to use and sell their forestland. The farmers' co-operative was entitled to have right to use and share farmers' income.
1958-1978	-People's Commune -Great Leap Forward	The commune was organised into three governing layers: production team, production brigade,	The commune was both owner and user of forestland. The commune owned the forest resources, manpower, and draft	Rapid collectivisation of resources for industrialisation and political

		and people's commune.	animal. The communes followed top-down directives from the county government and Central State.	campaigns. Forests were cleared for firewood during the Great Leap Forward Movement. Low productivity with illegal logging.
1978-1983	-Three Fix Policy -Forestland Responsibility System	Classified three forestland rights: (1) Individually-owned family plot, (2) Collectively-owned, and (3) responsibility hills.	In individually owned family plots, farmers were entitled to the rights of use, making profits, and inheritance. Farmers were freely to select the crops to grow and sell it market on their own.	Logging certificate should be issued and cutting within quota. Ten Years Forestry Development Program increased farmers' incentives to grow bamboo shoots and trees. De-collectivisation and means of production returned back to individual farmers. However, rural forestlands' ownership still belonged to collectives. Socio-political control was less tight when compared to the communal period. Unclear forestland boundaries cause conflicts.
1997-1998	-National Forestry Protection Programme (NFPP) -Slope Land Conservation Programme	Ban on logging on natural forest to preserve forest. Convert croplands into forestlands. Redefine the functions of natural forests into (1) conservation forests, (2) economic forests.	Under the responsibility system, the Lin'an state contract out the slope lands and wastelands for farmers to grow bamboo shoots.	Farmers and collectives have to apply for logging and shipping permits, and follow the annual cutting quota before cutting timber. The marketing of timber was sold under market prices and under the State Forestry

				Administration's monitoring. Growing bamboo provides substantial incomes for farmers. The economic incentive attracted farmers to grow bamboo shoots on the barren hills and reduce soil erosion problems.
1998-2028	Extension of forestlands responsibility system	Household's user rights of forestland can be transferred, auctioned, mortgaged, and invested. Land cannot be sold. Profits and transaction costs should be shared and distributed by a single owner or different owners. The rural collective still owned the lands and there is a logging limit issued by the state.	Contracted out the rest of the collectively owned forests to individual farmers and extended the contracting periods from 30 to 50 years. Rural collectives determined the decision making of land contracting. Increased market mechanisms to govern the forest resource through land contracting, joint-venture, renting, shareholding, and auction. Forests were classified into two major categories: conservation and economic forests. Increased farmers' responsibilities and rights to manage forest resources and make production decisions.	Increase farmers' incentive to preserve forests with a longer time of contracts because of longer contracting years. Lack of adjustment of forestland holding causes conflicts in forestland boundaries.

Under Maoist communism, class struggle was used to establish the socialist regime by re-organising rural socio-political order in Lin'an County (Li, 1995). The land reform in Lin'an uprooted the rural ruling class and confiscated the landlords' means of productions to achieve collectivisation (Schurmann, 1966, p.431). Through the land reform, the communist cadres in Lin'an re-organised private ownership into socialist communes by redistributing the means of production, including farmlands, tools, and draft animals from the hands of landlords to farmers. Under communism, the governance structure in rural Lin'an was a hierarchical 'responsibilities and controls' system through a top-down structure[9] of people's communes, production brigades, and production teams (Unger, 2002 pp.9-11). Li (1995, p.336) further argues that the people's commune was a governance structure that "combined the political and social organisation of the rural areas" which "was the product of Mao Zedong's petit bourgeois fanaticism". The Central State crafted out a production plan and compulsory production quota for every five-year period. The plan and quotas became the production guidelines for Lin'an people's communes to follow; communes had to concretise the plan into detailed production missions to achieve the required production quota, to be delivered by the State. Former production team leader Mr. Liu in Xia Gao village commented, "People's Communes and Production teams could not fail the production mission; otherwise the whole team would be punished and criticised by the upper level officials" (Interview, No F01, 2012).

In Lin'an County, the Forestry Bureau had to achieve the assigned quantities of wood and bamboo shoot production from the Central State's compulsory procurement system. Forest and bamboo shoot resource transactions were under fixed procurement and marketing prices (Xu, 2005).

[9] The production team was the lowest unit in the communal system which was under the control by the production brigade; while the production brigade was controlled by the leader of the commune.

Lin'an farmers not only produced forest resources under the state's procurement system but also they were also required to produce paddy for the Central State. Former production team leader Mr. Liu in Xia Gao village commented,

> In our commune, farmers were organised into production teams to achieve the Central State's compulsory grain mission and the state purchased the grains with fixed prices. Production teams had to produce fixed amounts of paddy as a grain tax (皇粮国税)…if the production team over fulfiled the state's mission, the rest of the rice could be sold in fixed prices such as 8 to 10 Yuan RMB per 100 kg in Lin'an (Interview with bamboo shoot farmer No F01, 2012).

There was an unequal exchange between the Central State and the people's commune in Lin'an because the Central State purchased woods and bamboo shoot materials under the market value (Chan, 1994; Lardy 1983); however, people communes had to purchase the fertilisers and machineries at high prices. This price differences is called "scissors pricing" (*Jia ge jian dao cha*) (see Figure 11) which "linked to the movement of scissor blades; the differential will remain, just as the edges of the scissor blades will never overlap" (Li, 1995, p.185). Yet, the distribution of remuneration was based on a wage-point (*gong fen*) system, which was the proportion of individual farmers' shares and labour input. Each year, there were two times to evaluate an individual household's work performance in the communes. In each evaluation, the team leader and other farmers in the commune evaluated every individual household. However, the evaluation was not based on the productivity and time inputs. This system allowed the People's Communes in Lin'an to allocate the quantities of commodities to individuals for every wage-point without using the currency wage system (Li, 1995 pp. 130-131).

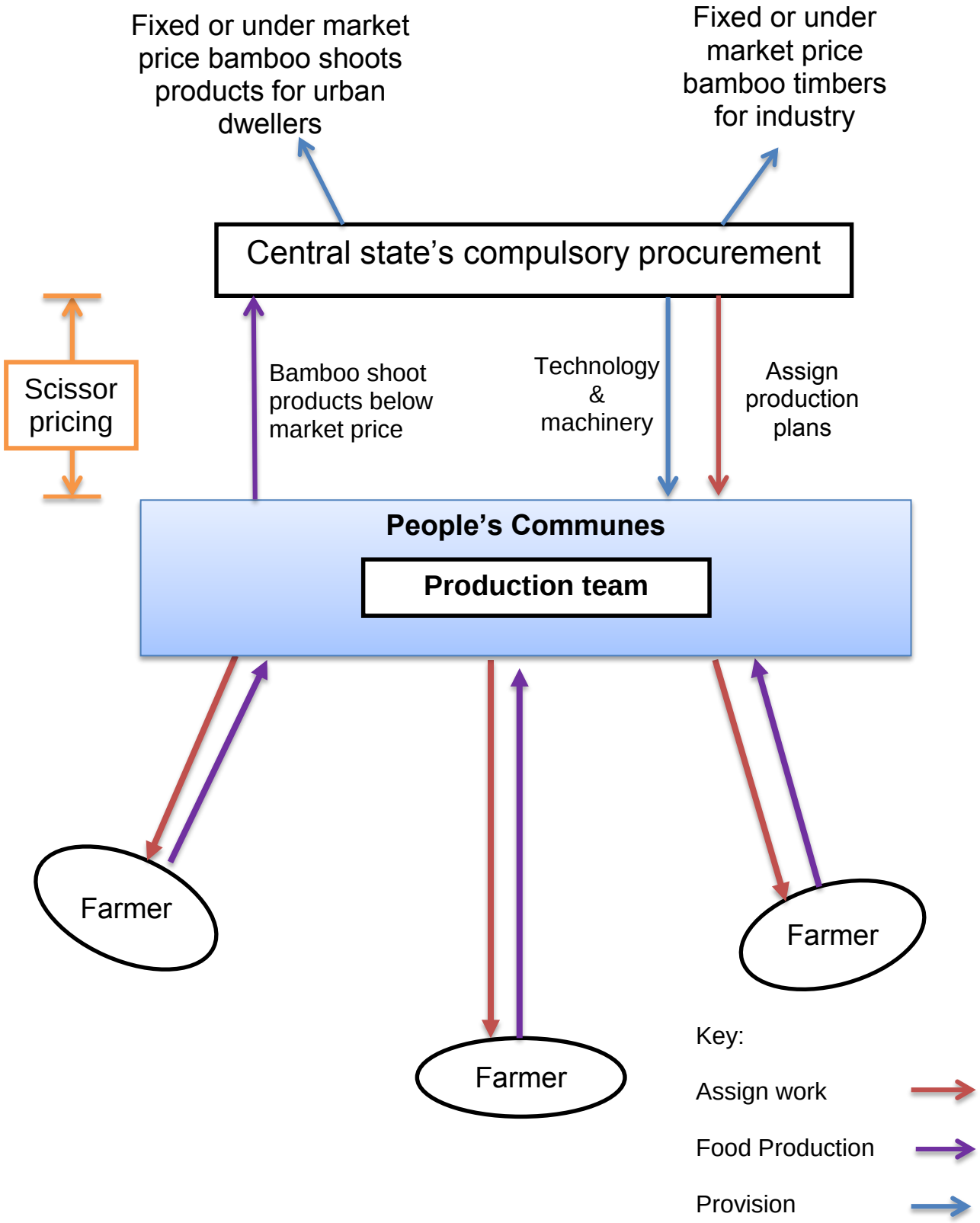

Figure 11 The Scissors Pricing Mechanism

In the people's communes, policy delivery and decision making in the forest and bamboo shoot resources allocation were influenced by two major factors: (1) top-down command and control, and (2) national political campaigns. For instance, in 1950, the Central State promulgated the policy to "popularise forest protection, focus on tree planting, rational logging and rational use of resources" (Xu, 2007, p.91-92). In response to The Central State's policy, the 5th People Representative Meeting in Zhejiang in 1955 formulated a forestry management directive for 22 county governments to "eliminate barren hills and greening the whole province within seven years" (Xu, 2007, p.92). To implement this directive, the Lin'an state promoted two major tree planting concepts: (1) "protect the forest, protect the hill through self-afforestation, self-nurturing, and self-cutting" and (2) "who plant who harvest[10]". These concepts became the state's governing objectives to implement afforestation plans and appeal to people's communes, communist cadres, and individual farmers to plant camellia, mulberry, pine, fruit trees, and Moso bamboo on barren hills (Zhu 1997, pp.180-184). To implement these concepts, the Lin'an state directed independent action through village level cadres to establish afforestation co-operatives (Xu, 2007, p.93). Within this co-operative, greening brigade and teams were established. Each greening team divided its duties into a seedling procurement group, planting action group, and skill instruction group. Individual farmers had to achieve an assigned mission of tree planting from the production team leader.

4.2.1 Top down command-and-control

The decision making of the afforestation programs was delivered from top-down commands and controls from the Lin'an County government to the county-level forestry bureau; then the forest bureau distributed production missions to

[10] The who plant who harvest concepts means those forest and bamboo shoot products, which were growing on the barren hills, belonged to the production teams.

the people's communes. Between 1955 and 1956, 45,000 farmers participated in the mass afforestation movement and 660,000 stems of trees were planted on roadsides, riverside, and around farmers' houses and villages which covered 10, 000 mu areas in Lin'an (Xu, 2007). This large scale of afforestation was co-ordinated by the Lin'an state and Lin'an Forestry Bureau to recruit a large amount of farmers to participate in tree and bamboo planting.

The steering approach in the tree planting programmes (1955-1957) was characterised by Lin'an state's leadership and Lin'an Forestry Bureau's unified afforestation plans and field research (Xu, 2007). Under the Lin'an state's leadership, high-ranking communist cadres and government officials took the initiatives to recruit farmers for afforestation and the word *Tuju* (literally means assault) was used by the county government to describe the timing of tree planting as flexible and sudden. For instance, the different tree-planting events were launched with Lin'an state directives under special events include the Women's Day and Young Communist League gathering (Xu, 2007). These assault actions on forest and soil conservation could come from different levels of government and rankings of communist cadres' initiatives (Xu, 2007).

To implement the tree-planting programmes, the Lin'an Forestry Bureau carried out long and short-term afforestation planning. For the long-term planning, the forestry bureau considered the economic potential and geographical conditions to select appropriate tree and bamboo types for the tree-planting site. Then, the Lin'an Forestry Bureau conducted a field study to understand the gradient, soil, drainage conditions, size of the afforestation, and physical conditions of those barren hills in order to select appropriate tree and bamboo types. Once the tree and bamboo types were identified, the Forestry Bureau implemented short-term planning by assigning concrete missions and planting quotas to production communes, preparing the required number of tree and bamboo seedlings, and calculating the necessary labours for afforestation.

Finally, the Lin'an state set the date for afforestation and organised higher-ranking communist cadres to work with farmers in barren hills to plant trees.

Apart from the top-down command and control mechanism, major national political campaigns include the Great Leap Forward Movement (1958-1960) and Cultural Revolution (1966-1976) also affected the policy delivery and decision-making in forest resource allocation (Harkness, 1998; Ross, 1980; Trac et al*.,* 2007). Particularly, the Great Leap Forward Movement caused lots of forests to be cleared down all over China for iron refining and rice production (Shapiro, 2001).

4.2.2 National political campaigns

From 1958 Chairman Mao launched the Great Leap Forward Movement to boost agricultural and industrial production within a short period of time by encouraging all farmers in China to melt down iron and refine steel, with the aim of surpassing Britain and catching up with the United State's steel output (Saich, 2001). In so doing, chairman Mao appealed to 600 million farmers to construct a new form of socialist life in the countryside by exploiting the forest and metal resources for iron refining to overcome resource scarcity and economic downturn in socialist industrialisation. The principle of "taking the steel production as the key link" (*yi gang wei gang*) was used to boost the iron and steel production for sluggish economic growth in the late 1950s (Li, 1995). The entire nation was in a rally of producing the biggest quantity of steel; this increased demand for coal and fuel wood for iron refining. In Lin'an, a large forested area was logged and most of the hills became barren because the Zhejiang province's lack of coal resources for iron refining, with the solution being to set a high firewood production quota for Lin'an County with the goal of substituting coal with fuel wood.

> Lin'an became the provincial hotspot for wood production…in the township of Chang Hua, the whole village had to produce 100,000 dan[11] (擔) (5,000,000 kg[12]), while Lin'an had to produce 300,000 dam (15,000,000 kg) of woods for exporting to Zhejiang province including firewood needed to satisfy iron refining needs in Lin'an. This causes the most catastrophic deforestation in history. The whole forest was lumbered and it created lots of barren hills; even those precious tree types were cut. The capacity of the forest was plummeted from 860,000[13] hm^3 [square hectometre] to 360, 000[14] hm^3 [square hectometre] which accounted for a 58.1% decreased in the total forest within a year (Xu, 2005, pp.96-97).

The result of the Great Leap Forward movement was resource scarcity and soil erosion in Lin'an County. On the one hand the provincial government set a high production quota, which caused massive deforestation in Lin'an County. On the other hand, production teams in mountainous Lin'an were over-depending on selling firewood to obtain income. Both of these factors caused the vicious cycle of over-cutting, soil degradation, forest depletion and the problems of poverty in Lin'an County (Niu and Harris, 1996; Smil, 1997, p. 35-36; and Harkness, 1988, p. 921).

To understand how farmers perceived the problems of forest resource exploitation during the communal period, this research asked a survey question to understand what the major causal factors of logging were during the collective period. In this survey, the majority of farmers (54.5%) believed that major reason for logging during the communal period was caused by poverty. One farmer Mr. Xu from the Bai Sha village commented that, "farmers were over-depending on logging because selling firewood was the main income source for the production team; farmers were very desperate because there was not much wood left on the

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[11] One dan equals to 50 kilogram (kg).
[12] This research adopts the measurement units including kilograms (kg), hectares (ha), and millilitres (ml). There are two major references made to the Chinese measurement units: (1) "mu," which is equivalent to 0.15 hectare and (2) "jin," which is equivalent to 0.5 kilogram (kg).
[13] It is equivalent to 860,000,000,000 cubic meters.
[14] It is equivalent to 360,000,000,000 cubic meters.

mountain" (Interview No F03, 2012). Another farmer Mr. Xia from the Bai Sha village commented that, "If selling wood was not profitable, it triggered more logging…and at the communal period, the Lin'an state didn't have enough monetary resource and the government was unable to provide financial resources to protect the forests" (Interview No F31, 2012). This farmer's comment reflects what Harkness's (1998, p.913) argument that the very low prices of forest resources during the communal period led to "constant overcutting" in the forestry system. In fact, during the communal period, forest resources were treated as free goods with low procurement prices, which led to negligent, and inefficiency in resource allocation. Another farmer from Xia Gao village Mr. Liu commented on the efficiency of forest resource allocation during the communal period: "there was lack of economic incentive during the collective period because the values of forest resources were low; and resource wastage was common in the People's communes because they didn't manage the forest well and because of a lack of efficiency" (Interview with bamboo shoot farmer No F05, 2012).

In short, the allocation of bamboo shoot resource during the communal period was characterised by top-down policy delivery and collectivisation. There was no free market to allocate bamboo shoot resources instead a centralised procurement system was used by the central government to procure bamboo shoots for urban dwellers. The central government dominated the decision making processes in devising afforestation plans and initiating political campaigns; the Lin'an state had to follow the Central government's commands to recruit farmers to achieve the tree planning missions and the bamboo shoot and wood resource production quotas. The problem of overcutting wood resources induced the vicious cycle of environmental degradation, low productivities of wood, and poverty in the Lin'an County.

4.3 Forest governance during the reform period

Until 1978 market reform, the Lin'an state was entitled to economic autonomy to develop their local specialised industry and decollectivise people's communes. The Lin'an state was aware of the socio-economic and ecological potentials of growing bamboo shoots to rejuvenate the degraded forests whilst maintain the economic needs of Lin'an farmers. Since 1983 the Lin'an state provided forestlands, knowledge and skills, and technical assistance to help farmers to earn their living and restore the degraded forest ecosystem during the early reform period. The following section is going to elucidate the governing objectives, policy implementation, and resource allocation under the Forestland Responsibility System (FRS) (林業生產責任制) in Lin'an County. This research argues that governmental initiatives – notably the Central State's afforestation directives – and the decentralisation of economic rights were important factors for the Lin'an state in usage bamboo shoot cultivation to increase farmers' incomes and solve soil erosion; this is demonstrated through exploring the interaction between the Lin'an state and farmers with regards the growing of bamboo shoots.

4.3.1 Forestland Responsibility System (FRS) in 1983

During the market reform, the Central State realised the potential of de-collectivisation and re-distribution of the rights of use of lands and forest resources (e.g. bamboo, tea plantation, and hickory trees) from the hands of people's communes to individual farmers. Forestland re-arrangement marked the new phase of forestry production because it implied a change of use value to enhance the exchange value of forestland because the forestland de-collectivisation offered the 'right of use' and 'right to derive income' to individual farmers to increase productivities. On 8 March 1981, the State Council issued

"Several Questions and Decisions About the Forest Protection and Forestry Development" (The State Council, 1981). This document directed the Lin'an County government to implement the FRS. Li (1995 p. 95) explains that this system was "combining the initiative of individual households with specialised and socialised production and by loosely linking remuneration to output, the new system diversifies production, promotes the use of scientific techniques, and stimulates commodity production". Under the forestland responsibility system and the Forest Law in 1981 (Lei and Guangcui, 2004), Lin'an farmers not only enjoyed the rights for economic determination but were also entitled to have legal rights over bamboo shoot resources, responsibilities over bamboo plantations' management, and economic benefits obtained from bamboo shoot resources.

Since 1982 the Lin'an County government has implemented the Three Fix policy to activate the Forestland Responsibility System (FRS) in bamboo shoot production to contract forestlands to individual farmers. Commentators argue that the de-collectivisation of the forestland with well-defined property rights can safeguard long-term forestry productivity, guarantee efficient resource allocation, and environmental sustainability (Coase, 1960; North, 1983; Alchian & Demsetz, 1972). Hardin (1968)'s *The Tragedy of the Common* points out that if the forest resources are opened, individual's rational self-interest will over-exploit the forest resources and cause environmental degradation. Scholars further argue that forestland contracting with properly defined property rights, it would reduce undesirable situations include cadre corruption, huge transaction costs in land reallocation, and environmental degradation (Ash & Edmonds 1998; Brandt et al, 2002, Brown 1995; Gao, 2004; Johnson, 1995; Prosterman et al*.,* 1996). However, other commentators assert that environmental degradation and land stability does not necessarily relate to statutory land titles (Lanjouw & Levy, 1998). The customary and communal arrangement can be more efficient than well-defined property right's land arrangement (Ho, 2005, p.6). The de-collectivisation of forestland and resources in Lin'an County provides a

compelling case study to understand whether or not land contracting increases the efficiency of resource allocation and reduces environmental degradation.

In Lin'an, the land contracting was begun over a period from 1983 to 1998, with fifteen-year contracts in the early stage of the contracting and thirty year contract extension periods between 1998 and 2028. By following the State Council's policy document, *The Decision on the forestry protection and development in 1981* (The State Council, 1981b), the Lin'an County government classified three major types of tenure arrangements in Lin'an (see Table 6): (1) family plots (zhilushan), (2) responsibility hills[15] (zerenshan) and (3) collectively-owned[16] hills (jitishan) (see Table 6).

According to Xu (2005, p.146), in 1982 the total forestlands in Lin'an County was 246, 800 hectare; among 42, 700 ha (17.3%) of forestland was delimited as family plots in which farmer household were entitled to enjoy the rights of use and inherit the lands (see Table 6). The majority of forestlands (49.5%) in Lin'an County were designated as responsibility hills in which a shareholding management system was established between farmers and the rural collectives. The rural collectives contracted out former communal lands to individual farmers. In return, farmers had to pay annual rent for the rural collectives (Xu, 2005). Both the family plots and responsibility hills provided farmers' autonomy to make their own farming decisions, including types of crops, ways of cultivation, and priorities of their farming schedules. Forestland

[15] Responsibility hills (責任林): This forest space refers to the individual rural household contract with the forest lands from the rural collectives. Individual farmers possessed the rights of use and derived income from the bamboo properties. From 1984 onward, bamboo forests and new growth of bamboo areas became farmers' economic properties. There were two rounds of contracting periods: the first round of the contract period was 15-20 years and the second of the contracting period was 30 years extends to 2031.

[16] Collective owned forest (農村集體所有林): These forest spaces were owned by the township and village-collectives

certificates were issued to individual farmers [17] to clarify the rights, responsibilities, and economic benefits they could be obtained on their family-owned and contracted responsibility hills and with regards the forest resources. Around 33.2% of forestlands were demarcated as collectively-owned hills in which the forestlands and forest resources belonged to township or village level's rural collectives. The rural collectives operated the forest farms or bamboo forests to produce timber for both the state and market. Decision-making in the forest farmers was decided collectively among collectives' members (see Table 6).

Table 6 Management Agreement of Forestlands in Lin'an County in 1982

	Tenure arrangement	Types of lands	Decision making in production	Proportions in total forestlands was distributed
Family plots (zhilushan)	Family household enjoys the right of use and in heritance. Forest resources on the lands belong to households	Lands adjacent and attached to farmers' houses	Individual farmers	42,700 ha (17.3%)
Responsibility hills (zerenshan)	The collective owns the land and resources. A shareholding management system was developed between individual farmers and collectives	Lands were contracted out from the rural collectives. Yet, lands were allocated in a fragmented manner.	Individual farmers	122,200 ha (49.5%)

[17]The rights, responsibilities, and economic benefits of the forestlands are retrieved on March 22nd, 2012 from the State Council's website: (http://www.gov.cn/zhengce/content/2010-12/29/content_2876.htm)

Collectively-owned hills (jitishan)	Township or village collectives operate the forest farms and non-forest farms. The rural collective employ farmers to manage the farms. The collective owns the lands and resources	The collectives owned forestland and resources. The management of the forest farms can be unclear because the township, village and farmer households managed the forest farms in Lin'an	Rural collective	81,900 ha (33.2%)

Note. The table is reference to Xu (2005, p. 144); Liu and Edmunds (2003), and Zhu (1997)

4.3.2 The process of de-collectivisation and land contracting in Lin'an

In 1983, during the early stage of the contracting period, the Lin'an County government collaborated with the Lin'an Forestry Bureau to conduct the Forest and Land Resource Survey to delineate boundaries of the mountain, clarify the forest rights and responsibilities, and issue forest land certificates for individual households (Lin'an Forestry Bureau, 2008). This land survey was conducted in every village in Lin'an by investigating the forest resources ranging from the size and boundary of the contracting plantation area, grading the soil, measuring slope conditions, and counting the number of wood stands. The Forestry Department used the data to estimate the exact amount of annually harvested woods and bamboo shoot resources.

Then, the Forest Bureau technicians visited different rural collectives in Lin'an to assist rural collectives to establish Land Arbitration Group (LAG)[18]. For instance, in 1982 the Lung Shau Shan's rural collectives divided the Lung Shau Mountain into three major sections and contracted out collectively owned forestlands to three production teams. The number of the population in each farmer households was crucial for the LAG in Lung Shau Shan to determine how much forestland the rural collective should allocate to each household. The time frame for the first contracting period in the Forestland Responsibility System (FRS) was 15 years and there was a little adjustment of the land ownership according to any change of household population in every three years. For instance, if one farmer had five people in 1982 and that decreased to four households in 1985 because of death and migration, then he/she had to give out one mu (0.15 ha) of forestland to those households that had increased in their population and vice versa.

With the assistance from forestry technicians, the LAG in Lung Shau Shan evaluated the quality and boundary of forestlands and delineated four major categories of lands: (1) good land (high clay contents, near river, and fertile) or (2) bad land (sandy, far away river, and infertile), (3) land near to a village and (4) land far away from a village. After classifying the quality and boundary of these four major categories of forestlands, the LAG adopted a ballot to distribute former collectively owned lands to individual households in Lung Shau Shan. Each household selected one representative to draw lots to see if he or she could obtain a good land by luck.

[18] The forestland arbitration group comprises the representatives from rural collectives and village's group leaders. The leaders were former production brigades' and teams' leaders.

In fact, to formulate the criteria to distribute forestland equally and fairly was difficult because of two major reasons: (1) the delineation of the forestland boundaries was difficult and (2) the distribution of forest resources had high variations in term of gradient, slope facing, and altitude (see Figure 12). To mitigate these two challenges: first, the LAG in Lung Shau Shan carefully distributed economically vuluable trees, including pine trees, Chinese fir, tea plantations, and bamboo, to each farmer households on the hills. Second, the LAG tried to visualise and delimit the forestland boundary by using, rivers, ridges, special tree types, stones, human marks (e.g. a knife to cut part of the tree bark) and making a line on the soil toward the foothill in order to indicate the line of each single plot of forestland. The quantity of forest resources will be approximately represented into numbers and kilograms.

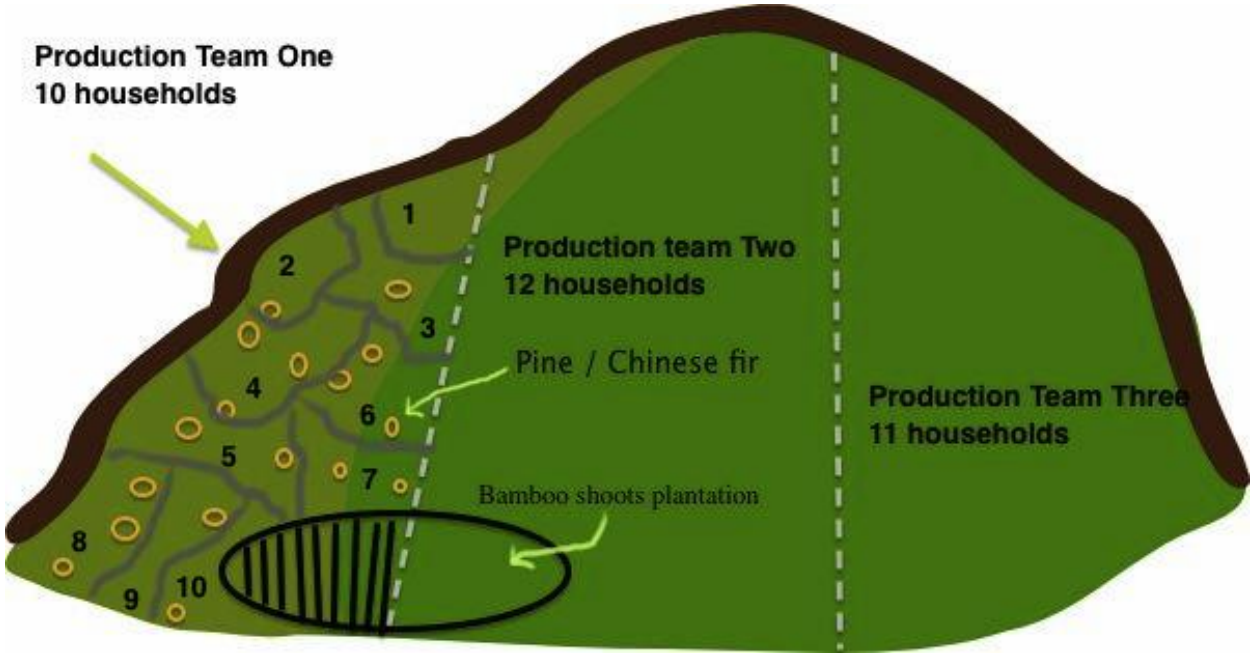

Figure 12 Variations in Land and Resource Condition

For instance, production team one had 10 households; each plot of land had different forest resources, gradients, and fertility conditions. Since there is an

uneven distribution of forest resources include pine trees, Chinese fir, and bamboo forest in each plot (see Figure 12), a further redistribution occurred in which a farmer who benefited by growing a favourable plot was expected to redistribute part of the forest resources with his/her neighbours. For instance, if farmer A got 50 pine trees and his neighbour farmer B got 10 pine trees. Then farmer B was allowed to negotiate with farmer A to get 10 % of the pine trees. This meant Farmer B had the right to share Farmer A's 5 pine trees. The distribution of bamboo shoots plantation was easier when compared to pine trees and Chinese firs because, as Lung Shau Shan farmer Mr. Xu commented, "bamboo shoots grow in clusters which could be distributed in strip forms" (Interview with bamboo shoot farmer No F03, 2012). Although there was a differences in terms of gradient, sun-facing or fading, and soil fertility of forestland, Mr. Xu commented, "if a farmer could not get fertile forest lands, this was the farmers' bad luck because they had a chance to shuffle the good lands as same as the other farmers" (Interview with bamboo shoot farmer No F03, 2012).

At the early stage of market reform, farmers in Lung Shau Shan did not know how to start their bamboo shoot production and they required the rural collectives' guidance; peer effects from their neighbours also influenced their farming decision and practices. Bamboo shoot farmer Mr. Liu from Lung Shau Shan commented that,

> Market prices and mechanism were completely new to us; we didn't know how to start capitalist production by our own because we got used to the collective production during the communist period. We prefer receiving production commands and guidance from the production brigade to free market economy …therefore, we followed the rural collectives' guidance and our neighbours' farming practices when the rural collectives encouraged us to grow [Ph. Nuda and moso] bamboo shoots, we followed suits (Interview with bamboo shoot farmer F10, 2012).

To guide farmers to participate in the forestry production under market reform, the rural collectives and communist cadres in Lung Shau Shan guided bamboo shoot farmers to grow moso bamboo for timber production and Ph. Nuda bamboo shoots for dried bamboo shoot processing. According to the Lin'an Bamboo Shoot Industry Association (1991), the communist cadres and rural collectives led bamboo shoot farmers to manage the Ph. Nuda bamboo plantation through intercropping with hickory nuts and tea plantations and to clear out bushes; the productivities of Ph. Nuda bamboo shoots increased from 10,000 kg to15,000 kg between 1989 and 1991.

After contracting the forestlands, the Lin'an state aimed at using policy directives and market mechanisms to encourage farmers to grow bamboo shoots to rejuvenate the degraded forest and help farmers to get rich. To achieve this objective, on the one hand the Lin'an state collaborated with rural collectives and village-level communist cadres to promote bamboo shoot cultivation through the technical extension, knowledge production, and demonstration household establishment. On the other hand, the Lin'an state guided farmers to seek the speculative opportunity and realise the market potential of bamboo shoots to get rich. The implementation and co-ordination of the afforestation program was no longer the government itself; instead the demonstration households and bamboo markets also played a crucial role. There were increas in flexibility and synergy effects in the bamboo shoot production industry.

4.3.3 Extension of forestlands contracting system in 2003

In 1998, under the Central State's policy directive of the "Implementation and Development of Forestland Use Transfer Mechanism[19], the Lin'an state stipulated the "Notice of Implementation of the Extensions of Forestlands Contracts and Forest Right Certificate" (Lin'an State, 2001). In this notice, the Lin'an state affirmed that the collective ownership of the forestlands and resources could be contracted to other private enterprises and individual farmers including wastelands, bamboo, and pine tree plantations. To facilitate and monitor the extension of exiting forestland contracts from 30 years (1998 to 2028) to 50 years (2050), the State Council revised the "Forest Law[20]" to protect the legal rights and economic benefits over individual farmers' contracting the "right of use" (依法转让使用权), setting price for shareholding (作价入股), auctioning, and establishing joint venture (合资) to afforest and manage forests with other farmers and enterprises. The revised forest law (1998) protected the collectives' and leasers' rights and responsibilities. To better protect the forest resources, the Lin'an state institutionalised the forestry classification system and categorised two major types of forests: conservation[21] and commercial[22] forests (Liang 2012). With better forestry classification, the Lin'an state could more effectively manage forest investment, and the use right of forestland transfer, acquisition, and control (Liang, 2012, p.60).

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[19] The policy document titled, "The Opinions about the Implementation and Development of Forestland Use Transfer Mechanism in 1998 No. 5" (Lin'an Forestry Bureau, 1998).
[20] Forest Law (1998) See also in http://www.china.org.cn/english/environment/207457.htm
[21] In Lin'an county, there are three major types of conservation forests: shelterbelt forests (防護林), ecological community forests (生態公益林) under the forest ecological compensation program (FECP) and forests for special purposes (特殊林).
[22] There are three major types of commercial purpose forests in Lin'an county: timber forests, economic forests, and fuel forests.

To understand how forestland stability affects bamboo shoot farmers' incentives to grow bamboo shoots, the majority of farmers (94%, 47 farmers) agree that the longer contracting period increases farmers' incentives to manage and preserve the forests. Especially, if the contracting periods of the extension of the FRS was from 30 to 50 years; Mr. Xiao from Xia Goa village commented that "the longer period of forestland contracting will increase my confidence and incentive to input more money to grow bamboo shoot because if the land policy did not change; I feel more secure for long term investment (Interview with bamboo shoot farmer No F06, 2012). Mr. Xie from Xia Goa village also commented, "the forestland and bamboo shoot resource belonged to me; this is my responsibility to protect my property….so the longer contracting period of lands mean higher stability for the land tenure; I have more incentive to protect the forest and earn more money" (Interview with bamboo shoot farmer No F11, 2012). From the above comments, we can see that the longer contracting period of forestlands increases farmers' incentive and confidence to protect forests and conserve the bamboo plantation because of higher land tenure security. Additionally, farmers perceive their forest resources as property; to sustain their economic interests, farmers will put effort to conserve the forest nature.

4.3.4 Afforestation programs after land contracting

In 1982 Lin'an County government and the Forestry Bureau implemented the Ten Years Forestry Development Program (十年林業計劃). This program was to increase farmers' incentive to grow bamboo shoots and enhance the exchange value of forestlands through the implementation of: the forestry investment planning[23]; forestry intercropping practices[24]; forestry knowledge

[23] There were three major investment planning: long-term planning through timber production, middle-term planning fruit trees and short-term planning for bamboo shoots, tea, herbs and other non-timber forest products.

production; and technological extension (Zhu, 1997). The short-term investment plan for Lin'an County government was to provide subsides for farmers to grow bamboo shoots and guide farmers to practice intercropping. The governing concept of the Ten Years Forestry Development Program was "greening the mountain, stabilizing the cultivation of paddy, and utilise the middle range of steep mountain" (上促青山，下穩良田，主攻中間). The Lin'an Forestry Bureau proposed the 'Eight Advantages of Growing Bamboo Shoots' and recommended the Lin'an state to use bamboo shoot cultivation to utilise the middle range of steep mountains. The Lin'an state adopted this proposal and entrusted the Forestry Bureau to conduct a bamboo resource survey to understand what specific types of bamboo shoots could bring good economic potentials and be grown to overcome the geographical constraints in mountainous Lin'an.

Based on the survey result, the Lin'an Forestry Bureau (LFB) identified three major types of bamboo shoots (see Table 7) because of three major reasons: (1) the Lin'an farmers have a long history of cultivation and sound artisan skills to cultivate Moso*, Ph. Praecox, and Ph. Nuda* bamboo shoots; (2) these bamboo shoots could generate huge economic value; and (3) different seasonality of these bamboo shoots could be produced to satisfy different market demands.

[24] Different heights of the crash crops and fruit trees were planted to utilise the forestlands. For instance, herbs and bamboo were grown below the fir and pine trees.

Table 7 Three Major Types of Bamboo Shoots in Lin'an

Bamboo species	**Local names**	**Shoot size**	**Seasonality/ Altitude**	**Features**
Moso Bamboo (*Phyllostachys heterocycla var. pubescens*) 毛竹筍	According to the harvesting seasons, moso bamboo shoots can be harvested in autumn (rhizome shoot), winter (winter shoot), and spring (spring shoot).	Large	November to mid-April Both high and low altitude	It is used for both fresh shoot consumption and processing for canned boiled shoots
Phyllostachys praecox (*Ph. Praecox*) 雷竹筍	"Lei" shoot, literally means thunder shoot. This shoot is harvested during the first thunderstorm in April. With early shooting technique, this shoot can be harvest in autumn and early spring.	Medium	January to mid-March Low altitude	It is used for fresh bamboo shoot consumption
Phyllostachys nuda (Ph. Nuda) 高節荀	"*Zhao zhu"* shoot is the local name	Medium	Mid-March to April Both high and low altitude	It is used for fresh bamboo shoot consumption, and seasoning and preserved bamboo shoots' processing.

Additionally, the Forestry Bureau strategically encouraged farmers to grow bamboo shoots based on different slope gradients. For slope gradients lower than 20°, farmers were encouraged to grow Ph. *Praecox* bamboo shoots; where the slope gradient was greater than 20°, farmers were encouraged to grow Moso bamboo shoots, *phyllostachys vivax* and *ph. nuda* bamboo shoots (Lin'an Forestry Bureau, 1994, p. 27).

After contracting out the middle range of mountain lands and identifying four major types of bamboo shoot resources for strategic development, the Lin'an state promoted the concepts of "scientific bamboo shoot management" and "getting rich through bamboo" (*Zhuzi Zhifu*) in rural Lin'an through technical extension services and demonstration households. The Lin'an state used administrative means to promote bamboo shoot cultivation by formulating the directive of "using five years to eliminate barren hills and spending ten years to green Lin'an" (五年消滅荒山，十年綠化臨安). Township and village level government officials were tasked with accelerating bamboo shoot cultivation on unutilised lands, hilly slopes, and farmlands (Xu, 2007, p. 32). According to a speech from a former forestry bureau officer in 1989,

> All levels of the government officials in Lin'an County had to unify the understanding and action on using bamboo shoots cultivation for achieving conservation, obtaining economic benefits, and steering for rural prosperity. The Communist Party members had to become demonstration households in the village to promote the concepts of elimination of barren hills. The core members of the Party had to formulate decisions with the village heads to encourage the whole village to take action [Translated by author] (Lin'an Bamboo Shoot Industry Association, 1989b, p.2)

The above speech reflected that there was a multi-level collaboration among county, township, and village levels of governments to promote bamboo shoot cultivation in the early reform period. Different institutional roles and

responsibilities were assigned to each level of government in a top-down forestry governing mechanism (it will be discussed in Chapter Five). To respond to the county government's directive, the Lin'an Forestry Bureau had to work with village level Communist Party cadres and farmer households to promote bamboo shoot cultivation to eliminate barren hillsides in three major ways. Firstly, the technology promotion committee in the Forestry Bureau was established to assign missions to the Forestry Substation and Forestry Technology Extension Unit's forestry technicians to identify appropriate villages, cadres, and farmers to promote bamboo shoot cultivation. Secondly, forestry technicians identified the appropriate villages to promote particular types of bamboo shoot according to the slope gradients and soil conditions; forestry technicians would meet the Communist Party cadres and village committee members. Thirdly, the forestry technicians provided lessons and technical descriptions for the village head and secretary of the Communist Party (村书记). When village committee and Community Party leaders accepted the mission from the Lin'an forestry bureau, they would invite and recommend potential farmers to become demonstration households in their villages. The whole process is literally called "grabbing the demonstration households"(抓示范) in the Lin'an language. According to a former communist cadre's comment, most of the Communist Party cadres at the village level had to take the lead to become the demonstration households to promote bamboo shoot cultivation first.

> After understanding the directives from the county government, the next step is to find appropriate forestlands to meet the policy goals. Our village selected ten communist cadres and retired cadres to formulate a professional group to till the land, prepare the seedlings, and cultivate and nurture the demonstration forest sites by fulfiling the mission (Lin'an Bamboo Shoot Industry Association, 1989b, no. 40, p.1).

From the above quotation, the directives from Lin'an state to promote bamboo shoot cultivation to eliminate barren hills and help farmers to get rich had been delivered from top-down hierarchical manner. The Lin'an Forestry

Bureau had to work closely with the village level of governments and party cadres in order to achieve the county government's mission; in particular, the role of party cadres in becoming the demonstration households and recruiting farmers to clean up the lands for bamboo shoot cultivation. According to a retired forestry bureau official's comment, "under the leadership of the Lin'an communist party, the communist cadres in *Xiangao li* village recruited all farmers to clean up the bushes and cultivate bamboo shoots in one single winter" (Translated by author) (Lin'an Bamboo Shoot Industry Association, 1989, no. 34, p.1).

According to Tang (2011), the economic incentive to grow bamboo shoot had reduced farmers' wood logging activities and preserved the forest biomass between 1980s and 2010s (see Table 8).

Table 8 Forest Transition from Degradation to Rejuvenation in Lin'an

	1980s	**2010s**
Quantity of wood logging	150,000 m^3	90,000 m^3
Forest coverage rate	64.1%	76.5%
Forest biomass	5,170,000 m^3	8,680,000 m^3

Source: Tang, 2011

In order to understand bamboo shoot farmers' perspectives on the effectiveness of growing bamboo shoots to solve soil erosion and logging problem, 56 surveys were conducted with bamboo shoot farmers. The majority of interviewed farmers (79%) from both Xia Gao and Bai Xia villages believed that the Lin'an state was effectively using bamboo shoot cultivation to conserve soil erosion. Additionally, a majority of bamboo shoot farmers (68.3%) responded that bamboo shoot cultivation could reduce logging and be an effective substitution for firewood. Detailed below are the expressed opinions of farms with regards the

performance of bamboo shoot cultivation for soil conservation and logging reduction.

Mr. Xia commented, “Bamboo shoot cultivation brought the greening on the barren hills with the coverage of bamboo and improvement of soil erosion on the steep slope since the rhizomes of the bamboo can effectively stabilise the soil and reduce soil erosion” (Interview with bamboo shoot farmer No F32, 2012).

Growing bamboo shoot also reduced farmers’ incentives to logging because farmers could earn substantial income from bamboo shoot cultivation. According to Mr. Xia, “Wood logging was not the only way to earn income. Growing bamboo shoots provided higher income return and stable income for farmers. Additionally, cutting wood was a daunting task…now we could substitute firewood with bamboo timber, use bamboo to produce charcoal” (Interview with bamboo shoot farmer No F33, 2012).

Besides that, some farmers believed that the contract forestland and bamboo shoot resources from the rural collectives had become their property therefore they were willing to conserve the forest. Mr. Wang commented that, “for economic reason, bamboo shoot farmers had to conserve their bamboo shoot plantation in order to sustain their life and earn their living through selling bamboo shoots. Therefore, farmers will protect the forest” (Interview with bamboo shoot farmer F09, Lin’an Zhejiang 2012).

From the above comments, one can see that the Lin’an County government was successful in using the bamboo shoot cultivation to green the mountain, tackle the soil erosion problem, and to help farmers to generate substantial income.

4.4 Discussion of the governance of forest resources and land organisation

Before 1978, a series of top-down afforestation plans and political campaigns dragged Lin'an forestry into a short cycle of contraction and expansion. For instance, the Great Leap Forward Movement in 1958 reduced the forest resources from 860,000 cubic meters to 360,000 cubic meters. In 1959, the Lin'an state realised the need to replenish the ecological loss by recruiting farmers to replant 19, 699 ha of forests, which covered more than 24 hills within a year (Xu, 2005, p.98). This short interval of forest change reflects the anthropocentricity of the Lin'an state to manipulate forest nature to achieve its green mission the provincial and central government's greening mission. The Lin'an Forestry Bureau even used the word "*Tuju*", which literally meaning "assault", to depict how the Lin'an state collaborated with bamboo shoot farmers to eliminate the barren hill as a battle in which people can challenge and overcome environmental limits (Shapiro, 2001; Harkness, 1988; Trac at al., 2007).

In an analysis of resource allocation in the collective period from an ecological modernisation perspective, Lin'an farmers under the Maoist political campaigns and rapid socialist industrialisation experienced negative impacts of resource exploitation and deforestation. Central government prioritised industrialisation to environmental conservation and downplayed the institutionalisation over environmental regulations and practices in the pre-reform period (Jahiel, 1998; Mol, 2006); there was a lack of a national regulatory framework (e.g. forest law) to regulate how the Central State's political campaign and people's communes overused the forest resources in Lin'an. The epitome of the forest exploitation in Lin'an was to achieve the compulsory firewood production quota of 15,000,000 kg of woods during the Great Leap Forward Movement. Whilst from political ecologist and eco-Marxists perspectives, the

focus is on the unequal exchange in resources transaction between rural communes in Lin'an and urban China because the Central State procured bamboo shoots and firewood products with low prices. On the one hand, this unequal exchange exploited farmers who produced bamboo shoots and firewood cheaply for the socialist industrialisation (Walker and Buck, 2007, p.44). On the other hand, resource scarcity and shortages were prevalent in the top-down hierarchical framework from the Central State, provincial, municipal, county to the people's communes (Tang, 1997, p.408).

During the market reform period, the Lin'an state maintained both command and control and economic measures to regenerate the degraded lands on steep mountains through bamboo shoot cultivation. Since 1982 Farmers have been recruited to grow bamboo and the bamboo area coverage was increased by 92% from 1985 (2,900 ha) to 2009 (55,777ha). The total forest area was increased by 84% from 1985 (186,333ha) to 2009 (343,333ha) (Lin'an Forestry Bureau, 2009). According to Tang (2011), the forest coverage rate increased from 64.1% in 1980s to 76. 5% in 2011, the standing volume of forest was increased from 4.86 million m^3 to 8.3million m^3. Based on the macro forestry data, Lin'an County did show a positive trend of forest expansion and bamboo cultivation did contribute to increase of the forest area. After three decades of bamboo shoot cultivation (1982-2012), in 2009 one quarter of the total forest areas in Lin'an was covered by bamboo forest (see Figure 13).

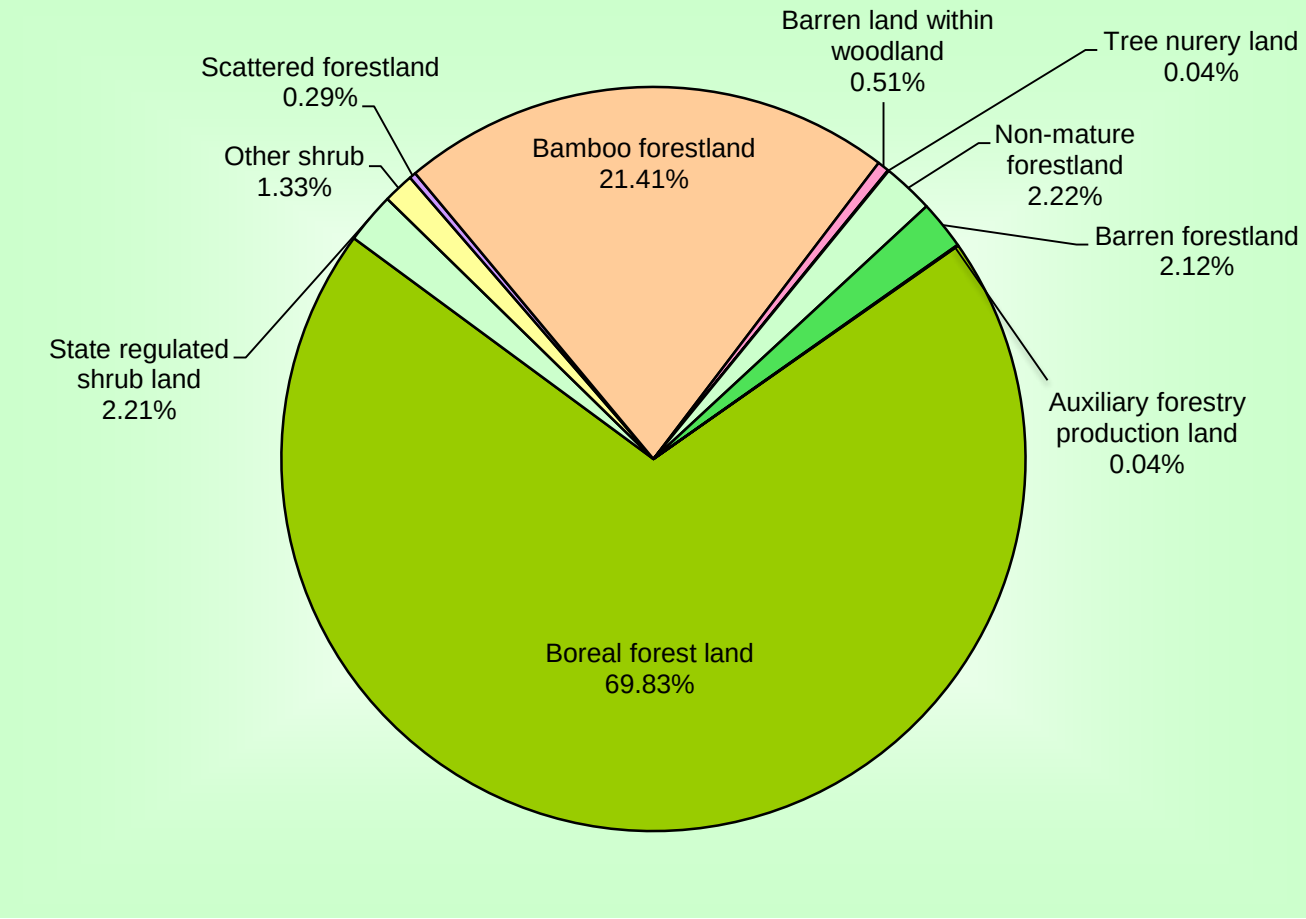

Figure 13 Proportion of Lin'an Forestland Use Coverage in 2009
(Source: Lin'an Forestry Bureau, 2009)

Growing bamboo shoots on degraded forestlands became a spatial fix; however, this solution created another ecological problem such as monoculture in Lin'an County. According to Zhu and Yang (2006, pp.28-29), around "76.7 % of the total 20,000 hectare of single-type of the shoot type is *Ph. Praecox"*. Figure 14 indicates the intensity of *Ph. Praecox* bamboo sequestrated carbon dioxide in 2008, the green dots represent the distribution of *Ph. Praecox* bamboo and the red dots represent the higher distribution of the bamboo shoots. The monoculture problem reflected the Lin'an state and the Lin'an farmers have been over-

depending on using bamboo shoot cultivation as a major solution to tackle soil erosion problem and generate income (see Figure 14).

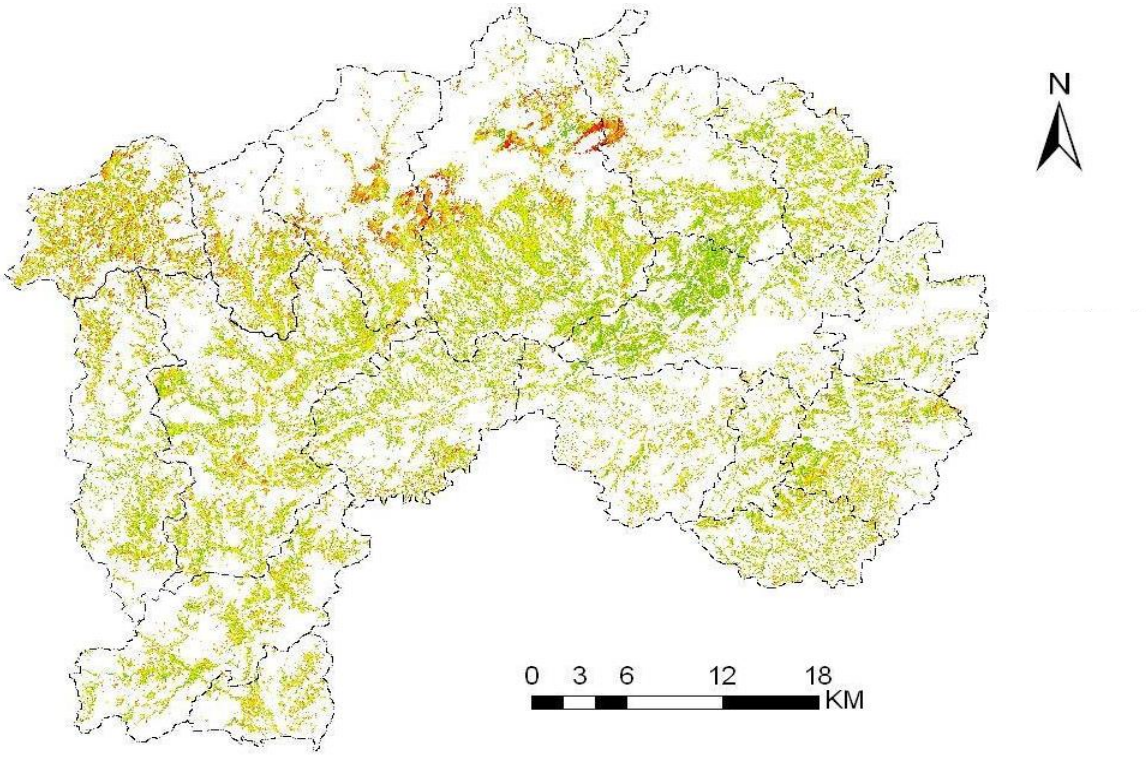

Figure 14 Distribution of *Ph. Praecox* Shoot in Lin'an County in 2008
(Source: Jiang et al., 2009)

In analysis of resource allocation during the reform period from ecological modernisation, we can observe a tendency of institutionalising environmental practices through marketising the use rights of forestlands' and forest resources' contracts, classification of forestland into conservation and economic purposes, ecological rejuvenation (e.g. Natural Forest Protection Program and Slope Land Conservation Program), and wood substitutions (i.e. wise use of bamboo shoots and fibres). This shows a positive transition from forest decline to expansion

through bamboo shoot cultivation and reflects the modernisation of the forest management institutions.

However, from the political ecologist perspective, the implicit problem of small landholding intertwined with monoculture produced two kinds of problems. First, the small landholding increases the environmental risk of bamboo shoot cultivation when farmers over-depend on a fast-growing method and chemical fertilisers usage to boost productivity in small plot of lands. The problem of improper use of fertilisers not only caused soil degradation but also polluted the water. Second, growing single type of bamboo shoot will cause monoculture, which is interrelated with pests and disease problems. To control the pests and diseases, farmers will use more pesticides, which will result in a biological accumulation of chemicals in the bamboo shoot supply chain. Guo et al. (2010, p.593) examine the organochlorine pesticide residues in bamboo shoots from the Zhejiang provinces; they argue that "detection rate of Hexachlorocyclohexane (HCH), dichloro-diphenyl-trichloroethane (DDT), and pentachloronitrobenzene (PCNB) were 100 %, 100%, and 75% respectively. Despite finding such high levels of pesticides in bamboo they still claimed that "in terms of residues concentrations of the pesticides, 82.14% of the bamboo shoot samples could be classified as safe (ibid.). Huang et al. (2001, p.7) argue that farmers tended to depend on pesticides usage to eliminate the epidemic pest and disease regions in Zhejiang provinces; in some areas the level of pesticides usage was higher than the country-allowed dosages. The problems of monoculture and over applications of pesticides quite clearly shot that the relentless use pesticides cannot solve the problem of pests and diseases.

From an eco-Marxism perspective, it exposed implementation defects caused by unsolved boundary conflicts in the Forestland Responsibility System (FRS), which the Lin'an state was not effectively able to solve. Before the extension of land contracting in 1998, there was a span of 3 to 5 years to adjust

the quantity of the contracted lands according to the number of households. The number of households can be changed because of births and deaths. Land adjustment was abolished after the extension of FRS in 1998. To understand the perception of farmers on the implementation defects of the FRS, in-depth interviews were conducted with a Bai Sha village farmer Mr. Xie commented that,

> The freezing of land adjustment was regressive and unfair because there is no land distribution for my new added family members after 1998. For instance, my family has three family members and I obtained three plots of responsibility forestland in 1983. As time went by, now added two more members and totally had five members in my family in the 2000s. Since 1998, there was a population changed in our village like my neighbour's daughter was married to a man in Anji County 9the neighbouring county], but there was no adjustment for the land holding in Lin'an County, my family still owned three plots of lands to produce bamboo shoots (Interview with bamboo shoot farmer No F14, 2012).

Another Bai Sha villager former Mr. Xia argued that the major reason why there was no adjustment of the quantity of the land plots in Lin'an County after 1998 was because "Lin'an state wants to build a harmonious society and stabilise the rural economy. So, land adjustment was abolished to avoid farmers' conflicts (Interview with bamboo shoot farmer No F31, 2012).

4.5 Conclusion

There is a shift from state-centric government to the co-existence of a hierarchical and multi-nuclei form of governance in the ways of resource allocation, policy delivery, and decision making from communism to market reform in Lin'an County. In the pre-reform period, the management of firewood and bamboo resources' allocations were under unified procurement and marketing. The Central State established people's communes to control farmers to live in the countryside in order to produce cheap bamboo timber for urban industrialisation and bamboo shoots for urban dwellers. During the market reform, both the state control and market mechanism were co-functioned to manage the wood and bamboo shoot resources. The implementation of the forestland responsibility system aims at de-collectivising forestland and means of production from the hands of rural collectives to individual farmers; it replaced resource allocation from a quota system to a state controlled plus market price mechanism.

To achieve sustainable development after 1978, the forest governance of the Lin'an state was extended from top-down hierarchy to include the market mechanism and individual actors to manage bamboo resources. The Lin'an state provided both policy guidance and economic environment to attract farmers to grow bamboo shoots to ameliorate soil degradation and generate income on their contracted forestlands. However, both small landholding implies fewer choice in resource use and over prioritisation of growing bamboo shoots in local development plan have generated two major environmental challenges: first, farmers have over-depended on using fertilisers to boost productivities and transform the seasonality of bamboo shoot to generate high economic return in a small land plot has caused soil degradation and pollution (see Chapters Five and Six). Second, over-growing bamboo shoot has increased the risk of pests and

diseases and farmers' remedial measures are depending on pesticide usage to fix this problem; however, it increases the risks of biological accumulation of chemical pollutants in the bamboo shoot food chain. To further understand how local government has prioritised bamboo shoot cultivation in local development plan and how farmers depend on bamboo shoot cultivation, Chapter Five is going to examine how local state and non-state actors use governing concepts, legal instrument, and policies to produce a conducive environment to strike a balance between economic development and environmental conservation, rationalise sustainable forms of forestry practices in institutional environment and regulate unsustainable forms of cultivation behaviours.

CHAPTER FIVE: GOVERNING CONCEPT, STRUCTURE AND PROGRAMMES

5.1 Introduction

The preceding chapter examines how the Central State in the early reform period decentralises land administration and land use rights to Lin'an County's rural committees and individual farmers to initiate bamboo shoot production. This chapter stresses how Lin'an state pursues the governance of sustainable development in the bamboo shoot production industry. It argues that the Lin'an state collaborates with non-state actors within both a state-centric and multi-nuclei governing structure to implement governing concepts, legal instruments, manage institutions and execute policies to achieve the sustainability of bamboo shoot production. The governing ideology of "building a relative wealthy society" imbues the Lin'an state and non-state actors to accumulate material wealth through bamboo shoot cultivation; while the function of a legal instrument (e.g. Forest law) is to rationalise and institutionalise sustainable forestry practices and control unsustainable forms of cultivation behaviours. To achieve the governing concept and execute legislation, this requires governing institutions from the Central State to county government to use these concepts and legislations to guide and co-ordinate the policies' and programmes' implementations in the bamboo shoot production industry in Lin'an County.

This chapter examines the governance of the sustainable development in the bamboo shoot production industry in three major ways: (1) questions whether the governing concept of "building a relative wealthy society" drives Lin'an state to prioritise economic development before environment conservation, (2) examines whether the forest law effectively rationalises sustainable forestry

practices and controls unsustainable forms of cultivation behaviours; and (3) addresses whether the institutional environment and policy instrument in Lin'an County promote sustainable practices across different actors.

This chapter is divided into five parts. Following the introduction, in section two, the vertical top-down concept rule of "building a relative wealthy society", legalising instruments (e.g. forest law) and managing institutions will be discussed. In section three, vertical networks of the forestry governance system from the State Forestry Administration (SFA), which cascades to the Lin'an Forestry Bureau (LFB), will be elucidated. It particularly, examines the vertical axis of policy co-ordination from the State Forestry Administration (SFA) to the Lin'an Forestry Bureau in which the key roles of state institutions and non-state actors through the hierarchy will be discussed. However, the details of horizontal axis interactions between state and non-state will be further illustrated in Chapters Six and Seven. Section four investigates those critical policies and events in Lin'an to achieve the governance of sustainable development in the bamboo shoot production industry and evaluate the opportunities and challenges, which affect the governing capacity of the Lin'an state, to achieve sustainability. Section five is the conclusion of this chapter.

5.2 Governing techniques in China's forestry governance system

To understand the governance of sustainable development in the bamboo shoot industry, this research argues that contextualising both top-down and bottom-up views of governing concepts' implementations, legal enactments, institutional management and policy execution provide a holistic picture of policy co-ordination and implementation between state and non-state actors to pursue sustainable development in the bamboo shoot industry (see Figure 15).

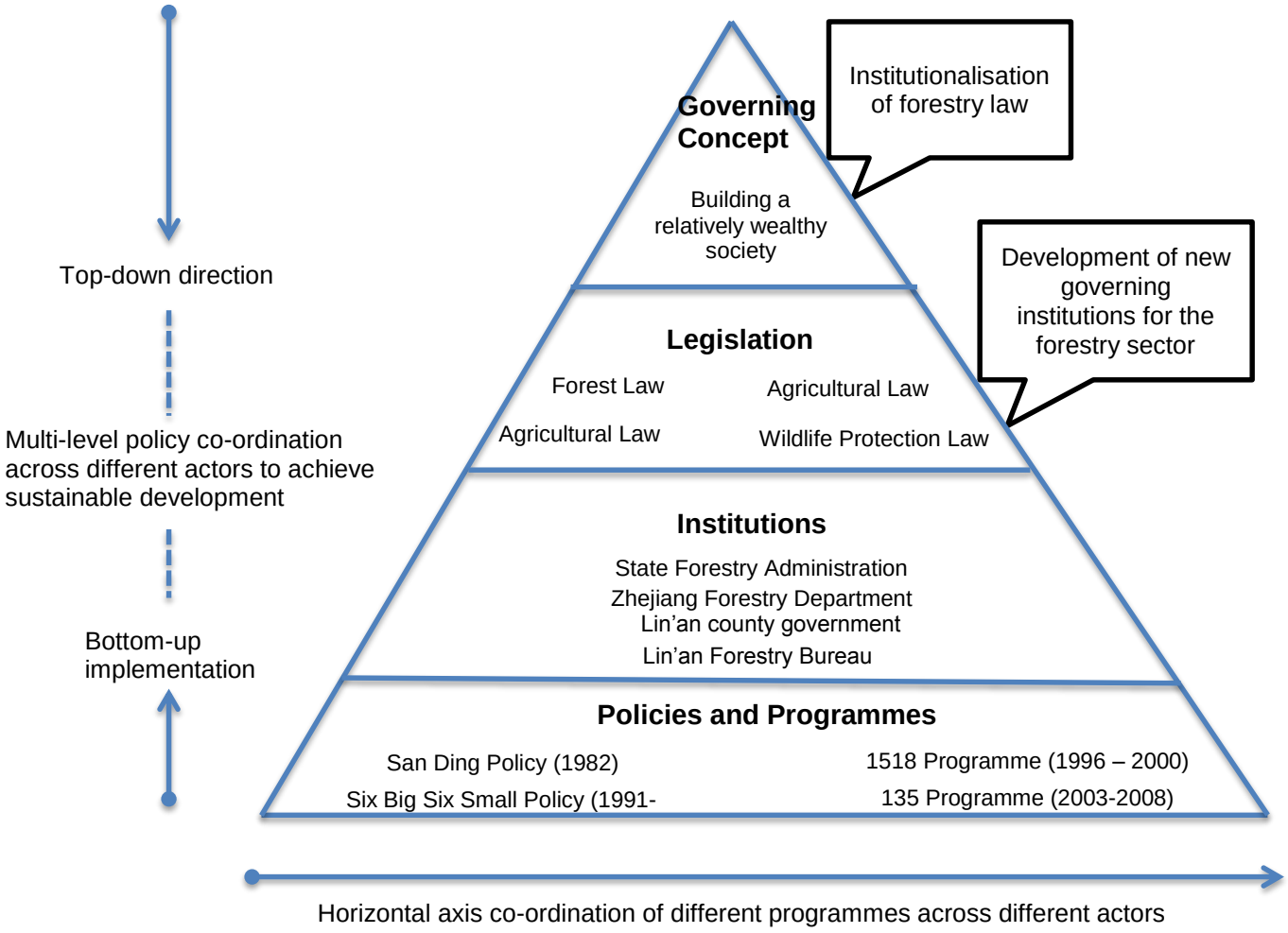

Figure 15 Top-Down Governance and Bottom-Up Implementation

Note. This diagram was taken from and modified from Brown et al., (2008, p. 86).

From a top-down policy analysis, the establishment of forestry institutions, regulations, the provisions of policy flexibility to maximise local state's economic growth, institutionalisation of forest law, and the increase of forestry governing institutions reflect the ecological rationality of the Lin'an forestry governance system (Ho, 2006; Mol, 2006; Lo and Tang, 2006). Particularly, the institutionalisation of forestry laws and priority cutting regulates forest users'

timber usages and reduces destructive logging behaviours (Ma and Ortolano, 2000). Through top-down policies and programmes' analyses (see Section Four), the Lin'an bamboo shoot production industry shows a tendency of ecological rationalisation by evaluating forestry bureau officials' performances with the achieving of a afforestation mission, collaborating international organisations to increase afforestation, and economising the bamboo forests with standardised production and carbon-trading (Economy, 2006; Jaihel, 2006; Lo and Tang, 2006). However, the top-down pro-growth governing concept imbued farmers to produce new bamboo forest for capital accumulation; this causes eco-Marxists' and political ecologists' the concerns of the conflicts between use value of bamboo shoot cultivation for soil conservation and exchange value production of the bamboo shoot for market sales (Castree, 2000; Swyngedouw, 1999). On the one hand, the conflicts between these two values are widening when the Lin'an state appeals to farmers to adopt the "early shooting techniques" to manipulate the seasonality and shooting performances of the bamboo shoot production to meet the market demands by applying lots of fertilisers and covering materials. On the other hand, when farmers over-depend on exchange value's extraction without conserving the soil fertility, carrying capacity and biodiversity affects the ecosystem. This will increase the vulnerability of the bamboo shoot production system and soil degradation, which will affect the livelihood of farmers in the long-term (Bryant and Bailey, 1997; Robbins, 2004).

These contradictory views on top-down analyses provide an apt entry point for this chapter to examine the governance of the sustainable development in the bamboo shoot production industry in three major ways: (1) questions whether the governing concept of "building a relative wealthy society" drives Lin'an state to prioritise economic development before environment conservation, (2) examines whether the forest law effectively rationalises sustainable forestry practices and controls unsustainable forms of cultivation behaviours; and (3)

addresses whether the institutional environment and policy instrument in Lin'an County promote sustainable practices across different actors.

5.2.1 Governing concept

Under a state-centred administrative bureaucracy, the delivery of the Central State's and State Forestry Administration's policies are cascaded to County level (He and Wu, 2009); however, the effectiveness of the governing concepts are all depending on the capability and leadership of local government (Oi, 1992; Smart and Lin, 2007).

Under Deng Xiao Ping's regime, "pro-growth mentality" becomes the core value and it refers to the new era of Chinese socialism turning from political revolutionary to incorporate a market-based economic revolution after 1978 (Lee et al*.,* 2012). This mentality was reflected in political and socio-economic life after the Eleventh CPC Central Committee in 1978 because Deng Xiao Ping promoted pro-growth economic policies in three major ways: first, it decentralised the economic right to encourage the local state to attract foreign direct investments (FDI) from overseas Chinese and establish Special Economic Zones in coastal areas. Second, it promoted export-led development and trickle-down economic resources to transform local economies along with privatisation of the state-owned enterprises (Bao et al*.,* 2002; Cartier, 2001; Naughton, 1994; Oi, 1995). Third, it allowed the local state to make profits from enterprising and land selling to maximise extra revenue for local government expenses and retain tax earnings[25], particularly in the county and township levels of governments (Lin, 2009; Oi, 1992 and 1999). In rural China, pro-growth mentality was expressed

[25] Oi (1992, p.103) succinctly documents how tax revenues were retained at the county and township levels during the early reform periods. She elucidated the system of "bottom-up revenue sharing" among different levels of government refer to central, provincial, county and township levels of governments.

through the development of township-village enterprises (TVEs), revenue maximising and GDP growth by utilizing the local state's comparative advantages including natural resources, industry's integration, and developing their place-based models (Wei, 2002; Wei et al, 2007). Concerning the governance of bamboo resources in Lin'an, the Lin'an state rather than marketing plays a leading role in developing the pro-growth governing concept, enforcing and implementing legislations to regulate resource allocation, and producing a conducive environment for the development of the bamboo shoot production industry.

According to the State Council Decision (2003), building a sustainable forestry system and facilitating the nation's forestry development are crucial means to achieve a "relatively wealthy society" (*Xiao Kang She Hu*). Anagnost (2008, p.502) explains that the vision of building a relative wealthy society plays an ideological role to emphasis the growing material's well-being. According to the Central State of the PRC (2006) the guiding principle of the State Forestry Administration (2006)'s mid-long term planning document also stated:

> The SFA's mid-long term planning is based on Tang Xiao Ping's theories and the 16th People of Congress's ideologies to devise plans for the ecological construction and sustainable development, to develop an ecological safety system through afforestation, and to construct an ecological civilised society through forest resources protection, recycling, and utilisation. All these propel China to build a relatively wealthy society (The State Forestry Administration, 2006, pp.1-3)

In 1983, to rebrand Lin'an as being a poor county to becoming a relatively wealthy one, the Lin'an state promoted the bamboo shoot industry by launching a countywide policy of "*Lin'an Jinqi Fan Liang Fan*[26]*, Zhuji Tiao Zhongdan* (临安经

[26] The term *Fan Liang Fan* (翻两番) was a policy slogan in Deng Xiao Ping's Four Modernisations ideology to boost agro-industrial productivity and to increase Chinese people's Gross National Productivity to 1, 000 USD in the early 1980s (Xin Hua News, 2014)

济翻兩番，竹笋挑重担) (literally, bamboo became a lever to quadruple the size of the Lin'an economy)" to accelerate capital accumulation and multiply farmers' household incomes. The Lin'an County government not only collaborated with the Forestry Bureau to guide farmers to grow bamboo shoots to multiply their income but also to accumulate their material assets. For instance, the average income of bamboo shoot farmers substantially increased: 317%, from 1995 (3,336 Yuan) to 2011 (13,926 Yuan) (Lin'an Forestry Bureau, 2012). The average rural poverty rate decreased from 60% in 1980 to 5% in 2000 (Lin'an Forestry Bureau, 2012). However, Bamboo shoot farmers derived a substantial income from fresh bamboo shoot selling and spent it on building "bamboo shoot houses" (竹笋房), literally means farmers earned the money from bamboo shoot cultivations to build their modern flat-top houses. One bamboo shoot farmer Mr. Liu from the Xiao Gao village described his material accomplishments:

> During the Mao's era, we were very poor during the 1960s. Most of our houses were tile houses built with mud and grasses….In the 1970s, we used the sand, mud, and some concrete to build the houses. Until 1988, most of the farmers started growing bamboo shoots and get[sic] rich, they could enjoy better livelihood by using bricks to build the modern flat top houses, we called it a bamboo shoot house (Interview with bamboo shoot farmer Xia Gao village F05, 2012).

From the above quotation, this farmer illustrated that growing bamboo shoots not only brought economic prosperity in rural Lin'an but also transformed the farmers' average incomes and improved their housing conditions, and material wellbeing (see Figure 16).

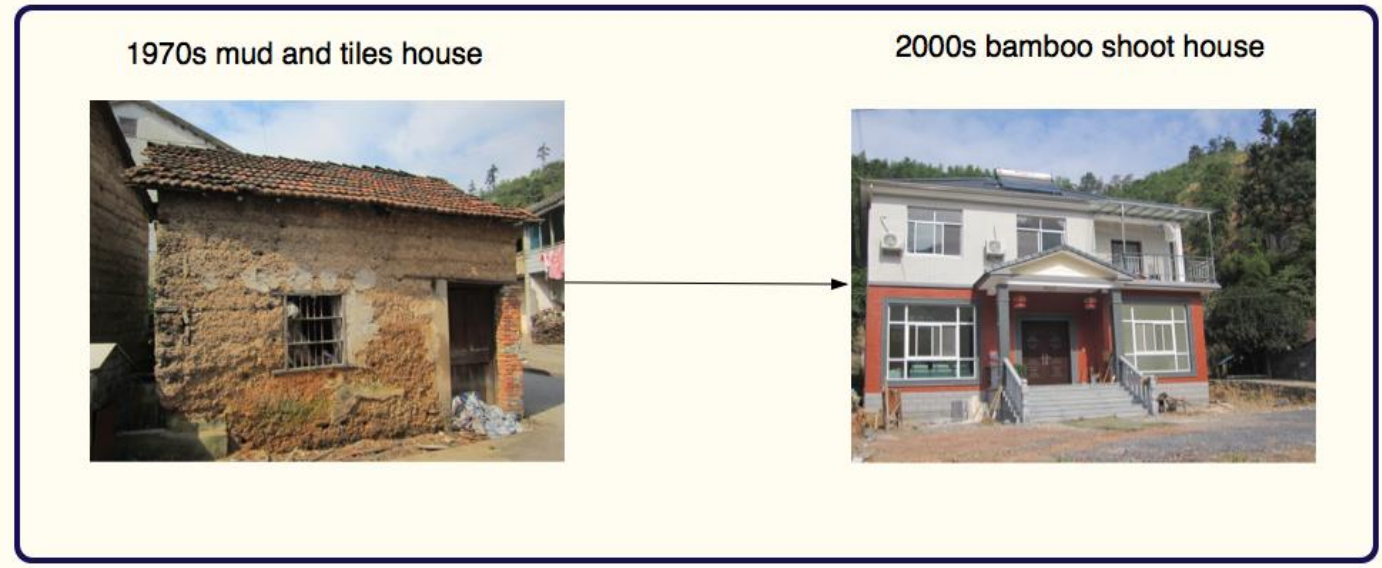

Figure 16 Improvement in Housing Conditions
(Source: Author's collection)

The bamboo shoot house represents a spatial visualisation of a relative wealthy society and demonstrates a symbol of westernised and modernised style of living in rural Lin'an. A well-furnished house and modernised instalments include air-conditioning with a solar energy panel were symbolised as a relatively well-off condition. Additionally, the incentive of bamboo shoot cultivation to achieve a relatively wealthy livelihood has transformed farmers' behaviours from wood logging to bamboo shoot cultivation, and changed from using firewood to a substitute of bamboo culm usage. From 1989 to 2008 there was a distinctive forest restructuring from industrial forest dependency (wood logging) to bamboo shoot cultivation (see Table 9). At the same time, the total conservation areas increased by 9.3% and the demands on the fuel wood forest were substituted by using bamboo timber (see Table 9).

Table 9 Using of Bamboo Timber as Substitute Firewood

Forest types	1989		2008	
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
Industrial forest (Wood production)	97,324	47.9	94,712	37.1
Fuel-wood forest	20,012	9.8	0	0
Conservation forest	18,404	9.1	46,923	18.4
Special purpose forest	1,421	0.7	13,925	5.5
Economic forest (i.e. bamboo shoots and other non-timber forest products)	66,020	32.5	99,325	39
Total	**203,181**	**100**	**254,885**	**100**

Source: Lin'an Forestry Bureau, 2009

Although the Lin'an state was successful in transforming farmers to accumulate material assets through bamboo shoot cultivation and reduce logging in the mountainside; this material-driven governing concept has created the problem of increasing land pressure and deteriorating soil quality in Lin'an County (see Chapter Four). Although the SFA and Lin'an County have formulated a system of resource management, monitoring, and promoting the substitution of firewood with bamboo timber now shows an observable trend of forest regeneration; economic rationality and wealth accumulation are still the dominant force to prioritise economic development before environment conservation.

5.2.2 Rule by legal instrument

In China, all forestry policies are formulated under the 1984 Forest Law (revised in 1998) and the law was issued by the 6th National People's Congress to legitimise the authority and decisions of the State Forestry Administration and different levels of forestry bureau. According to Richardson (1990, p. 187) "The [forest] law must be observed in all activities relating to forest cutting, utilisation, cultivation, and forest management and administration in the territory of the People's Republic of China". The Forest Law (1984) ensures rational use of forest resources with better classification, delineation, and management of the forests in China. For instance, forests were classified into two major items: (1) arbor (with distinctive tree trunk, canopy layers) and (2) bamboo[27] vegetation. Forestland is delineated as the 0.2 canopy density[28] (i.e. the density of canopy layer which covers the land surface) of tree, bamboo, shrub, scattered forest, lumbered land and nursery lands. Under the forest law, the forestry bureau can strengthen the management and control of forest users on timber and lumber on woods (e.g. pine, fir, and cypress tress), destructive behaviours (wood logging), daily forestry practices (e.g. firewood collection) and helps users to abide by the rules in the Forest Law (Chia, 2010, pp. 73-74). Apart from the basic Forest Law, China extends its regulations to manage those forestry related activities to include the Wildlife Protection Law, Seed Management Law, Agricultural Law, Co-operative Law, Food Safety Law and other Environmental Laws (e.g. Water Pollution Law and Solid Waste Pollution Law).

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[27] In Article 25, it stated that bamboo cultivation can be used as a means to increase the Forest Coverage Rate (FCR) through cultivating on the forestlands, shelterbelt, road sides, around the villages, water body and house sides.

[28] There are five major categories of canopy density: (1) < 0.2 is scattered forest, (2) 0.3-0.4 weakest canopy density, (3) 0.5-0.6 is weak canopy density, (4) 0.7-0.8 is medium canopy density, and (5) 0.9-1.0 is high canopy density.

The State Council is the chief executive agency in China and its ministries, commissions, and departments such as State Forest Administration (SFA) have issued a series of administrative directives to implement forestry policies stipulated in the Forest Law (Chen, 2012, p.35). Some of these directives include the “Several Questions and Decisions about the Forest Protection and Forestry Development” which concerned the forestland responsibility system to grant farmers’ rights and responsibilities to inherit their family plots and enjoy the forestland right of use. Another example includes the Major Outline of the Reform of the Forestry Economic Structure (1995), which provides legal bases for leasing the forestlands to other individuals or parties. The State Council issued both directives and the various levels of administration play a co-operative role to implement it and make plans cascaded from prefecture, provincial, to county levels’ government agencies. Brown et al*.,* (2008, p. 100) explained,

> The Centre makes policy and laws, provinces establish more detailed by-laws and regulations and are involved in co-ordination, prefectures implement plans and laws but do not make laws themselves as well as guiding and inspecting counties, while counties implement and make their own regulations, provide services, and guidance….Plans and measure become more detailed moving down the administrative hierarchy. Local level authorities are given significant scope to adapt laws and regulations to suit their own circumstances.

Building on Brown et al.’s (2008) argument that the Zhejiang provincial government is given significant capacity to implement laws and designate policy to fit its own situation; plans and measures become more specific cascading down the county level of administration. For instance, the Forest Law (1984) became the guiding principle for the Zhejiang provincial government to co-ordinate both economic development and conservation of forests. In 1993 the Zhejiang provincial government and the Zhejiang Forestry Department promulgated a provincial-wide “Forest Management Rules” to regulate the cutting of the wood and bamboo timber (Zhejiang Forest Resource Policy, 2004, No. 74,

p. 1). Until 1997, the Zhejiang province implemented the Natural Forest Protection Programme (NFPP) and aimed at banning logging and conserving natural forests in all counties in Zhejiang (Xu et al., 2006). The forest law became the legal base to halt illegal logging and unsustainable forestry practices in the natural forests (Chia 2010, p. 66 and Weyerhaeuser et al. 2005). To understand the effectiveness of the logging ban, this research conducted a survey with 56 bamboo shoot farmers to understand their perspectives on the impact of logging ban on their livelihood. The majority of farmers (64.7 %) commented that the logging ban had no influence on their livelihoods because of two major reasons: first, “the majority of farmers in Lin’an depended on bamboo shoots, hickory nut and tea production which provided alternative income sources for farmers even though the logging ban was implemented” (Interview with bamboo shoot farmer Mr. Liu F10, 2012); (2) the price of the wood was very low (less than two Yuan per cubic meter); farmers preferred to grow bamboo shoots to cut trees” because of economic consideration (Interview with bamboo shoot farmer Mr. Xiao F20, 2012).

In 2004, under the Forest law the Zhejiang Forestry Department (2004, p.1) issued a more detailed “Moso bamboo cutting and management policy” which regulates the quantity of the Moso Bamboo culm’s harvesting. On the one hand, this policy requested the county level forestry bureau to report the amount of yearly harvested Moso bamboo resources to the Zhejiang Forestry Department. On the other hand, the county level forestry bureau has to devise its own bamboo forest management policies to achieve the Zhejiang Forestry Department’s requirement. For example, in 2007 the Lin’an Forestry Bureau implemented the Moso Bamboo Forest Cutting Priorities Policy (竹林采伐管理政策) (Lin’an News, 2007).

Based on this priority cutting policy, the Lin'an Forestry Bureau established a system of bamboo resource management and was monitored in Lin'an County. Bamboo producers should document and identify the growing periods, ownership, size of the bamboo, and place a sign on each of the bamboo clumps to delineate their bamboo in their bamboo plantations (see Figure 17). Bamboo farmers should selectively cut their Moso bamboo forests, which have been growing more than six years and there is a clear-cutting period from 15th, September to the following March annually in Lin'an.

Figure 17 Marks made by Bamboo Shoot Farmers on their Moso Bamboo (Source: Author's collection)

Although the forest law enforces the legal power for the Lin'an state to implement the National Forest Protection Programme and the Moso Bamboo Forest Cutting Priorities Policy to use legislation to control unsustainable forestry practices (e.g. logging) and rationalise resource management; it does not mean that local state control unsustainable forms of forestry practices effectively

include using plenty of fertilisers and pesticides to manipulate the seasonality and productivity of bamboo shoot cultivation. Instead, the economic interest of growing the bamboo shoot is still the major driver to reduce the logging behaviours rather than the legal power to reduce famers' logging behaviours.

To implement the governing concept, forest law, policies, and programmes from the State Forestry Administration (SFA) down to the county level of government to promote sustainable practices, these require an institutional environment and governing institutions to provide supervision and co-ordination through the hierarchy. The vertical axis of policy co-ordination from the State Forestry Administration (SFA) to the Lin'an Forestry Bureau is illustrated.

5.3 Rule by managing institutions

There are five major levels of vertical authority (*Tiao*) in China's forest administration system: the State Forestry Administration is at the top (Liang, 2012, p. 56) and horizontal axis of authority (*Kuai*), is a forestry governing institutions at the local level (Lieberthal and Lampton, 1992). The vertical axis is coordinated by forestry functions and the horizontal axis is coordinated by local government's needs (Lieberthal, 1997, p. 3). The major function of the SFA is to provide guidance and supervision on forestry management and protection over the whole nation (Liang, 2012). According to an in-depth interview with the INBAR official Mr. Zhu I quote his 30 year researching bamboo shoot cultivation in Lin'an County:

> The State Forestry Administration (SFA) provides governing concepts and policy directives for different provinces and counties in forest management and conservation. In Zhejiang province, the Zhejiang Provincial Forestry

> Department managed state-owned forestlands and conservation programmes, and supervised the plan delegated by the SFA. The Lin'an County government and the Forestry Bureau are the crucial players to implement those plans into workable and pragmatic goals (Interview with an INBAR official in Zhejiang I01, 2011).

From INBAR official's comments, the vertical administration cascaded from the SFA to county level forestry bureau. Lin'an County government and Forestry Bureau should follow the governing concepts (e.g. building a relative wealthy society) from the State Council and State Forestry Administration. This research argues that the delivery of top-down five-year planning and decision making from the SFA to Lin'an County through the vertical hierarchy is still prevalent though under the market reform.

According to The Forest Law Implementation's Rule 14 of (1984):

> The State Forestry Administration prepared the long-term planning and should get the approval the State Council. The lower level of administrative units should follow the upper level of administration's long-term plan. The long-term planning of each county bureau should be reported and approved by the provincial forestry department and the county government. Any changes and modifications of the long-term planning should be reported to the upper level of forestry department (Translated by author) (The PRC's Forest Law Implementation, 2000).

One INBAR's official Mr. Zhu who has been working over 5 years on a project in Zhejiang, and was therefore well placed to comment on government's top-down forestry planning:

> All plans from the central to local state should be implemented strictly; lower levels of governments have to adhere strictly to the upper state's plans. For instance, there are three major types of plans: (1) mid and long-term planning[29] (2006-2020), (2) five year plan, and (3) yearly plan from the level of State Forestry Administration (SFA) to the county level of forestry Bureau. Once the Zhejiang provincial forestry bureau receives the

[29] The mid and long-term planning include science and technology policy planning (2006-2020) Forestry development No. 175 [2006], renewable resources policy planning (2007).

mid-long term plan and five year's plan, the bureau had to turn those plans into pragmatic programmes for the Lin'an County Forestry Bureau (Interview with INBAR official Mr. Zhu I01, 2012).

From the INBAR's official comment, there is a top down monitoring and supervision system for the upper level of government through mid-long term plan implementation (see Figure 18). The delegations of mid-long term plans maintain the essence of a former socialist Five-Year Planning that the Central State provides for governing concepts, plans, and guidelines for national economic development over a period of five years. For instance, in 2001 the 16th People of Congress delivered the governing concept of building a "Relatively Wealthy Society" for the SFA to co-ordinate forest conservation and economic development in each level of government (see Figure 18).

Figure 18 Delegation of Mid-Long Term Planning From SFA to Lin'an

(Source: Lin'an Forestry Bureau, 2003)

When the top-down plan was delegated from the SFA to provincial level, the Zhejiang Provincial Forestry Department (ZPFD) responded by further formulating appropriate policy directions to fit the future forestry development in Zhejiang province between 2001 and 2005 (see Figure 18). The ZPFD devised the policies of "Building Green Zhejiang and Ecological Province" and provided development guidelines for county level government to achieve the policy goal of building a "relatively wealthy society" in Zhejiang province. To respond ZPFD's policy directives, the Lin'an state advocated the "One-year, Three-years, Five-years Socio-Economic Development Programme" (135 Programmes in Short) in 2003, which aimed at promoting bamboo shoot cultivation to bring Lin'an County into a "greening county" and achieve the vision of building a "relatively wealthy society". To implement the 135 Programme, the Lin'an County government collaborated with the forestry bureau to formulate project agenda to strengthen forestland requisition and management, setting measurable targets to upgrade the quality of bamboo shoot production, and established officials' evaluation criteria to enhance the bamboo shoot processing and marketing (Lin'an Forestry Bureau, 2003).

The Lin'an state co-ordinates together the greening and economic development through bamboo shoot cultivation in the 135 Programme, the Lin'an state aims at integrating the bamboo shoot greening plans into the economic development plan by establishing mission indicators to guide and monitor officials' to achieve both greening and economic development objectives. In the 135 Programme, there were 16 measurable targets in terms of bamboo shoot production, processing, and marketing to measure officials' performances (Lin'an Forestry Bureau, 2003, p. 6). For instance, between 2003 and 2007 of the mission targets was to establish high quality bamboo shoot production bases. The forestry bureau officials have to upgrade the quality of bamboo shoot production by building green and hazard-free bamboo shoot production bases

within the required time frames (see Table 10). The major reason to select this indicator is to illustrate how the Lin'an state pays attention to increasing bamboo shoot production quality by adopting technical measures to monitor government officials to achieve the expected mission targets.

Table 10 Evaluating Official's Performance

Time frame to achieve the missions	**Mission indicators or targets**
2003 Upgrade the quality of bamboo shoot production	• Established 26, 000 hectare of hazard free production bases (include bamboo shoot and hickory nuts) and developed 3,300 hectare of green bamboo production base (include bamboo shoot and hickory nuts)
2005 Further increase the quality of bamboo shoot production	• The total hazard free production bases should reached 66,000 hectare (include bamboo shoot and hickory nuts) and the green food production base should reached 6, 600 hectare (include bamboo shoot and hickory nuts)

Source: Lin'an Forestry Bureau, 2003, p. 6

Additionally, to help Lin'an officials' meet targets, a system of monitoring has been developed to evaluate their performances: (1) budgetary monitoring, (2) report filing, (3) project presenting, and (4) performance evaluating. The dispensation of punishment and awards depend on the effectiveness and achievements of the stated mission targets. In this sense, if lower level government officials in Lin'an County want to get a promotion, they have to strictly implement general directives from the upper level government into pragmatic decisions and workable projects on the ground. There is a yearly government official evaluation scheme to monitor whether forestry officers achieve the expected performance to receive the awards or punishments (Lin'an Forestry Bureau, 2003, p.162). One forestry officer, who has been working for

the Forestry Bureau more than 30 years, commented “for the awards, we had remuneration, medals endorsement by the state, and promotions. However, for the punishments, if we cannot accomplish the stated targets in the plan, there is a record to write down our complaint remarks, remuneration abolishment, and even demotion” (Interview with government official Mr. He G02, 2012).

In short, although the state-centric governance is prevalent in the bamboo shoot production industry, there is flexibility for the local government to implement programmes and projects in the market reform period. The Central State decentralises the rights for fiscal autonomy and responsibilities for the local government to propel economic development. This initiates multi-nuclei governing structure for the local government to co-ordinate with non-state actors. In Lin’an, the County government collaborates with the forestry bureau (1) to establish new institutions (e.g. farmers’ co-operatives, processors’ association, and bamboo shoot trading markets), (2) stipulate policies and projects, and (3) collaborate with farmers to create an environment to multiply farmers’ incomes, attract investments and increase vertical integrations of the industry. In the following section, this study is going to explain how the Lin’an forestry bureau interacts with the Central State actors, bamboo shoot producers, demonstration households, co-operatives, and rural committees. The major rationale of this section is to discuss the interactions between the state actors and non-actors through outlining the governing structure and networks of bamboo governance in Lin’an (see Figure 19).

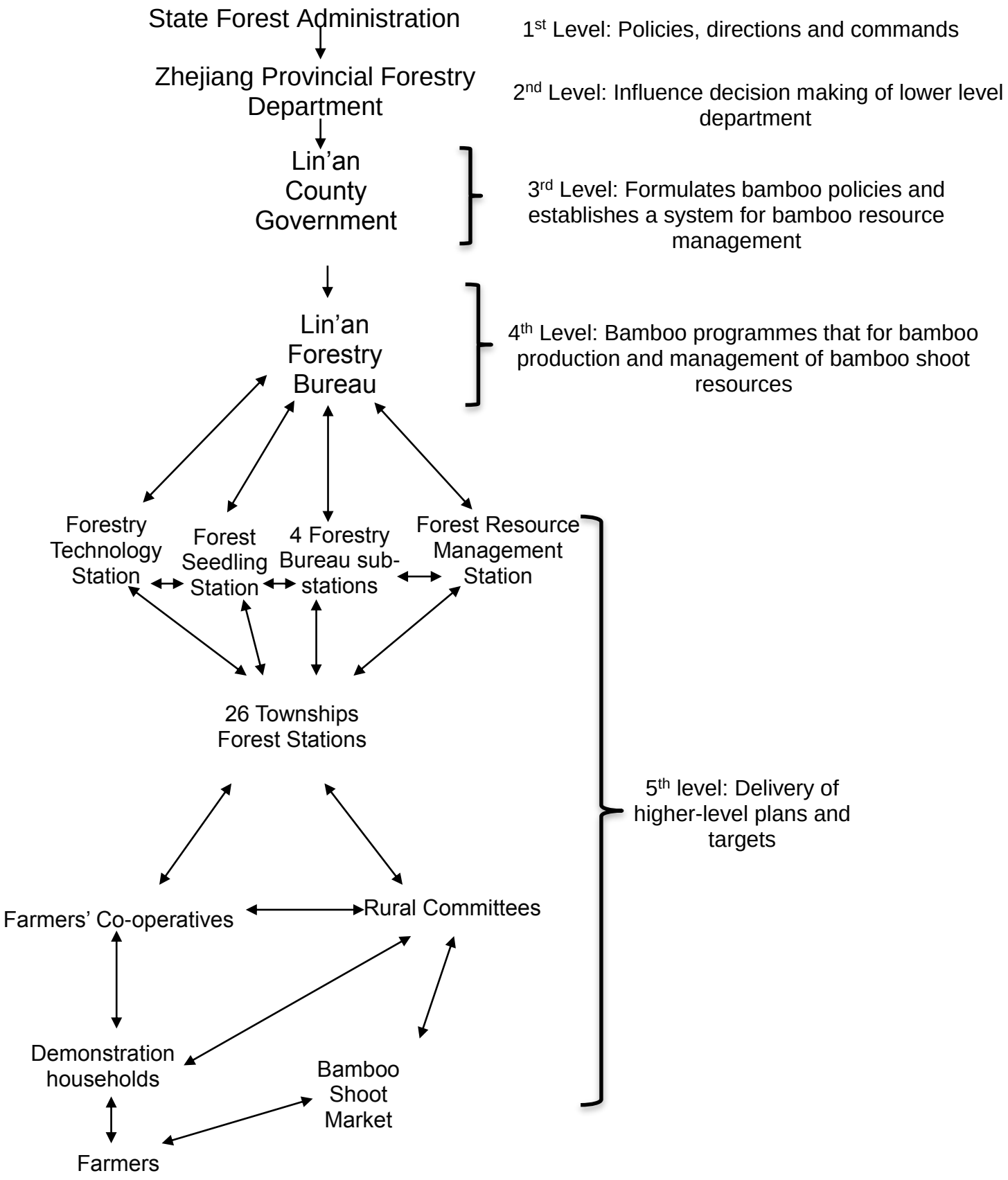

Figure 19 Governance Structure and Key Actors of Bamboo Resources in Lin'an

5.3.1 Lin'an Forestry Bureau (LFA)

The Lin'an Forestry Bureau was established in 1977 and the governing structure bureau was divided into five divisions: (1) forest resources and policy, (2) human resource, (3) afforestation, (4) anti forest fire office and (5) general office division (Lin'an Forestry Bureau, 2006, p. 4). In 1985, two new governing organs were developed – The Bamboo Industry Association and Forest Industry Division to deal with the bamboo shoot production, processing and marketing (Lin'an Bamboo Shoot Industry Association, 1985, pp.1-4).

The Lin'an Forestry Bureau not only follows the delegations and commands from the State Forestry Administrative and Zhejiang Provincial Forestry Department deliver on policy directions from the Lin'an County government (see Figure 19). Zhu (1997) but also explains that there are two major tasks for the county level government officials in Lin'an to develop the bamboo shoot production industry: first, county level government officials should attend Forestry Bureau's training courses in order to familiarise with the bamboo shoot cultivation policies and techniques. Second, county level government officials should conduct field visits with the forestry bureau's officials to learn about the ecological and socio-economic impacts in different villages in Lin'an County. After acknowledging the importance of the bamboo shoot production, the Lin'an state crafted the appropriate development programme (e.g. The 135 Programmes) to develop the bamboo shoot production industry.

The major role of the Lin'an Forestry Bureau is to focus on "monitoring the whole policy implementation processes and project results by not only using administrative measures but also to combine both legal, administrative, and economics means to boost the productivity and quality of bamboo shoot production" (Lin'an Forestry Bureau, 2003, p. 1). There are six major roles for the

Lin'an Forestry Bureau relating to bamboo shoots' production: (1) implement the Forest Law and Lin'an Forestry rules and regulation in the bamboo shoot production industry through policy and development planning, bamboo practices drafting, and organisation establishing; (2) assume responsibility for planting the bamboo forest, bamboo seedlings and seed management, and monitor the bamboo production and processing industries; (3) provide supervision and direction for county level bamboo resource management and surveys. Based on the resource survey, the Lin'an forestry bureau can estimate yearly bamboo culms and shoot production quantities and manage the processing capacities, and transportation planning; (4) offer guidance for bamboo shoot farmers, provide supervision on forestry technicians and officers, monitoring on bamboo forest policy works; (5) devise plans for bamboo forest development through forestry funds; and (6) organise and guide the Lin'an bamboo industry's science and technology development, education and training provision.

5.3.2 Three level rule of experts and the governance structure

There are three rule levels of expertise: head and deputy head of Lin'an Forestry Bureau officials, forestry technicians, and rural committees to steer resources to implement the bamboo shoot programme in Lin'an: the top-level of governance are the committee members who make decision, craft out a policy plan, and provide financial resources. In this committee, the heads and two deputy head of the Lin'an Forestry Bureau will lead the committee. Under the committee, there are 18 working groups within the forestry bureau and each group leader has to report to the committee members.

The second level of rule of experts are four major sub-divisions: (1) the four Forestry Sub-Stations, (2) Forest Resources Management Station, (3) Forest Technology Station, and (4) Forest Seedling Station in Lin'an Forestry

Bureau to execute the bamboo shoot production projects which were established in 1977 (Lin'an Forestry Bureau, 2006, p. 4). The Lin'an Forestry Bureau established four Forestry Substations in order to facilitate the delegation, implementation, and management of bamboo policies in township levels. These four sub-stations located in major agro-forest resources in Lin'an include *Chang Bei* (昌北), *Chang Hua* (昌化), *Yu Qian* (于潜) *Linglong* (玲珑) in Lin'an County. The Forest Resources Management Station (FRMS) is established to manage the production base of the bamboo and bamboo land property management, while the Forestry Technology Station (FTS) is formed to attract international funding (e.g. World Bank's funding) and foreign direct investment to invest in Lin'an bamboo shoot production. The major roles of the Forest Seedling Station (FSS) is entrusted to the Lin'an Forestry Bureau to conserve and monitor the quality of flower and tree seedlings, manage and provide licenses for the production base of *Torreya Grandis* (香榧), *Cleyera* and Eurya (杨桐柃木) as well as conserve and mange the bamboo seedlings (see Figure 19). To evaluate the performance of the forestry officials, the Lin'an Forestry Bureau implemented a "Forestry Production Evaluation System" to evaluate forestry officials' and technicians' achieved tasks and signed liability certificates, which is a management by objective certificate to illustrate the afforestation, forest resource management, capital levy and service provision responsibilities of forestry officials and technicians (Lin'an Forestry Bureau, 2003, p. 17). In this monitoring system, the division head in the Forestry Bureau became the project leader to co-ordinate, supervise, and dispense corresponding award or punishment on the progress of each project. To conduct job appraisals, the project leader evaluates officials and technicians' signed certificates with the actual achieved tasks for evaluating their performances (Lin'an Forestry Bureau, 2003, pp. 162-163).

The third level is the village head and rural committee members who collaborate with the forestry technicians to manage the demonstration households and bamboo shoot farmers. The forestry technicians and

demonstration households had close contact with farmers and understood the bamboo shoot problems from farmers' perspectives. According to Zhu (1997, p.103) the rural committee members act like the board of directors at the village level to manage bamboo shoot demonstration and production projects in their villages; while the forestry technicians and demonstration households act as managers to motivate farmers to participate in the bamboo shoot promotion plans and adjust programmes to meet the production targets (Zhu, 1997). Rural committee members and forestry technicians collaborate to choose appropriate bamboo shoots to fit villages' soil conditions, to devise bamboo shoot production plans to boost productivity and to increase farmers' incomes, and to conduct research on bamboo propagation and shooting performances. The Lin'an state dispenses awards according to the productivities of bamboo shoots in the villages, demonstration households, and forestry technicians (see Figure 20).

Figure 20 Demonstration Households Rewarded with Fertilisers
(Source: Author's collection)

5.3.3 The Rural Committee

The rural committee plays five majors role in the management of forestlands (including bamboo forests) in its village: (1) facilitates the forestland contracting mechanism for bamboo shoot cultivation; the rural committee prepares the land transfer contracts, which enumerate the land prices, rights and responsibilities for farmers to follow suit. In 2003, Lin'an County government promulgated 'The Implementation of the Extension of the Household Responsibility System Working Notice No. 32' in 2001 and rural committee in the forestry programmes to fulfil their missions to facilitate the collective land transfer and farmers' rights of use transaction through auction, open tender and lease in their village (Jiang, 2003, p. 133; Lin'an Forestry Bureau, 2003, pp. 149-150); (2) mediates and investigates the forestland conflicts among farmers; (3) achieves the missions of bamboo shoot cultivation and other afforestation, forest and wildlife protection; and (4) monitors the illegal logging, logging permits and log transportations in their village (Jiang, 2003, pp. 133-134). Additionally, (5) rural committees make plans to increase' living standards and meanwhile to accomplish the bamboo shoot production mission from the county government. In order to familiarise themselves with bamboo productions, committee members must participate in training courses and obtain forestry knowledge.

5.3.4 Forestry technicians

The Forestry Technology Station promoted bamboo production techniques and provided courses including bamboo species selections, intercropping with other vegetation to boost productivity, and forest conservation and age structure, and the management of the soil, water, temperature and appropriate usage of fertilisers and pesticides to demonstration households and farmers. These

courses can be operated in one day but even run for several weeks, and are conducted on farm sites but also the rural committees' assembly halls. According to Zhu (1997, p. 186) technicians spent more than 50% of their time in the field and they are "knowledgeable about new techniques, the ecological needs, and the farmers' economic desires." These technicians are crucial to promote bamboo production training services, provide place-based technical guidance, devise mid-long term planning, and write project proposals for the Lin'an County government with township cadres and demonstration households. The technological extension services provide bamboo shoot cultivation workshops (see Figure 21), pests and diseases prevention trainings, on-site instructions, and information on the latest bamboo shoot cultivation techniques. The forestry technicians visit the village in the evening and deliver training materials on a regular base or to village head or rural committee leaders requested it.

Figure 21 Forestry Technician Providing Training for Bamboo Shoot Farmers (Source: Author's collection)

Zhu (1997, p. 199) describes the functions of the forestry technicians as "working at the intermediary level in the forestry hierarchy system to understand farmers' needs and desires" and the technicians will then train the demonstration households to diffuse the techniques and knowledge for their fellow villagers. Forestry technicians "have a close relationship with all levels of the Forestry Bureau (ibid.)". To understand what services those farmers expected from the technological services, this research conducted a survey with 54 farmers to understand their perceptions. There are 46.9% of farmers (see Table 11) who expected the Lin'an state to keep providing technological extension services, especially pertinent techniques: (1) help regenerate degraded soil after prolonged bamboo shoot cultivation and (2) promote non-pollution shoot standards.

Table 11 Farmers' Expected Resource Assistance from Lin'an state

Financial support	21.9 %
Technological extension and support	46.9 %
Land transfer assistance	3.1 %
Expand the marketing channels	7.8 %
Maintenance the balance between economy and ecology	6.3 %
Others	14.1%
Total	**100%**

In the Lin'an's bamboo shoot production method, there are five major techniques that are promoted by the forestry technicians: (1) early-shooting, (2) non-polluted shoot production standards', (3) soil regeneration techniques to prolong bamboo shoot cultivation, (4) moso bamboo culms and shoot co-production, and (5) *Ph. praecox* shoot regeneration techniques. The forestry technicians also work closely with the research centres, universities and

demonstration households to devise new bamboo shoot cultivation techniques; the early shooting technique, in particular, has played a crucial role in increasing farmers' income since 1978. We learn much from the Lin'an Forestry Technician Mr. He, inventor of the early shooting techniques:

> To generate scientific data, I not only cooperated with one farmer household to borrow his small plot land to conduct experiment but also collaborated with the Zhejiang Forestry University to record the soil temperature and rate of shooting in three months continuously no matter in raining and snowing seasons. Every morning, I rode a bicycle from the city to the rural field to testify the appropriate covering materials to create a blanket effect and increase the soil temperature by using rice husk, plastic net, moso bamboo leaves. This method could increase the performance of the shooting of *Ph. Praecox* shoots to meet market demands before the Chinese New Year. The market price of the early shooting Ph. Praecox shoot could earn 4 Yuan before the Lunar New Year; while the normal shooting's shoot was just 0.4 Yuan per kilogram in 1998 (Interview of government official Mr. He G02, 2012).

In 1992, Lin'an farmers in Gao Hung Village, who followed Mr. He's early shooting technique, could earn seven to ten times more than from normal shooting of Ph. Praecox shoots because the early shooting shoots meet the high market demand before the Chinese New Year. According to Xu (2007, pp.7-8), villagers in *Gao Hung* Village are very keen to adopt Mr. He's early shooting techniques to increase their economic benefits from growing bamboo shoots. After applying the early shooting technique, the per capita household income in Gao Hung village reached 1, 700 Yuan per household …even a farmer in the early 1990s, who had fewer than 0.028 hectare (0.42 mu) of land, could earn 14, 681. 5 Yuan".

The Lin'an state promoted the early shooting technique to help thousands of bamboo shoot farmers to produce Ph. Praecox bamboo shoots during off-season in 1992. With the introduction of this technique, the total area of bamboo shoot plantation increased between 1993 and 1994 (see Figure 22). There was an increase of 15% of the total bamboo shoot area coverage within a single year

in 1997 and the highest annual increase in the past three decades. The percentage change of the total bamboo shoot cultivation area in Lin'an between 1983 and 2012 was increased by 120.9% from 26,070 hectare in 1983 to 576,000 hectare.

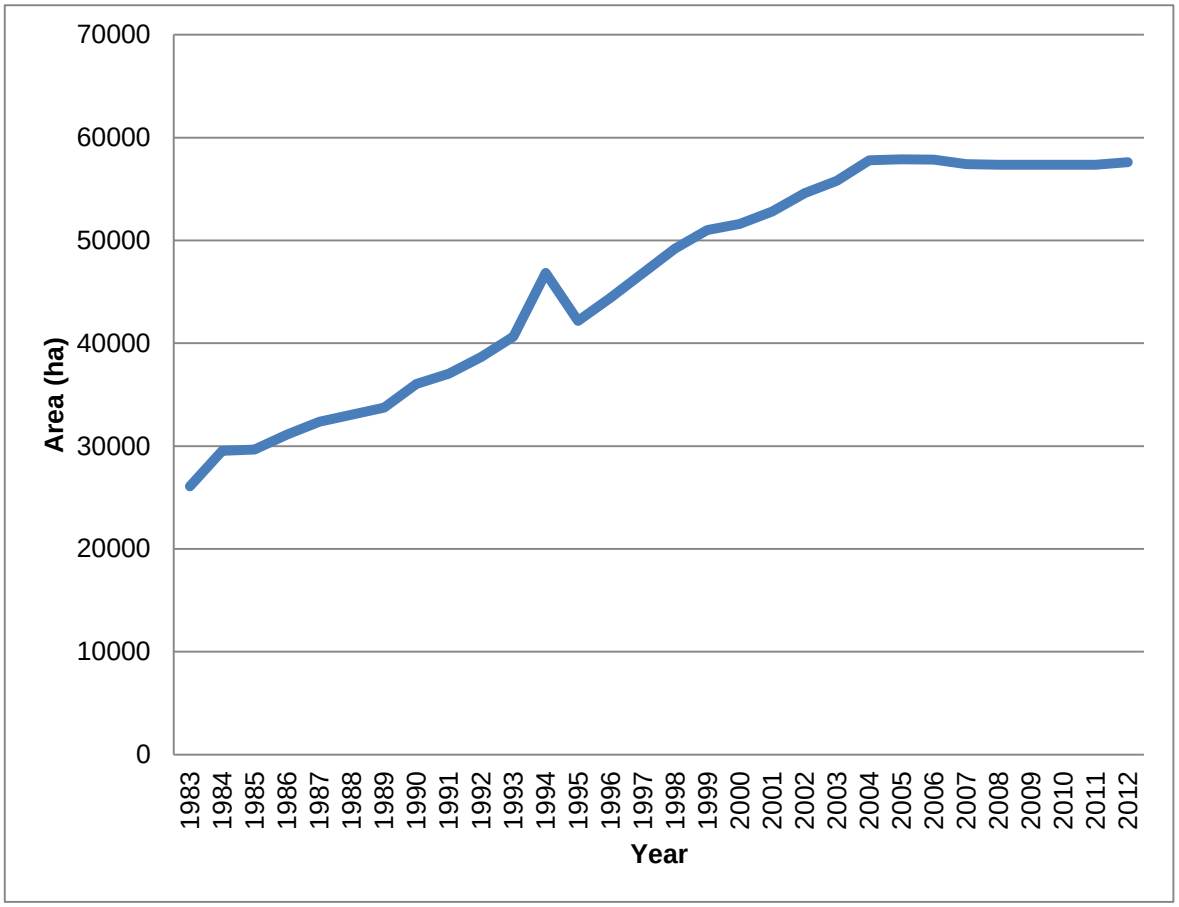

Figure 22 Total Production Area of Bamboo Shoots in Lin'an County
(Source: Lin'an Forestry Bureau, 2012)

From the above figure, the early shooting technique shows a significant increase of the bamboo shoot coverage area in Lin'an but also imbues bamboo shoot farmers with the concepts of market price, demand and supply, investment,

and surplus values. These concepts drive farmers to control the seasonality of the natural shooting of bamboo shoots to meet the market demands.

5.3.5 Demonstration households

The demonstration households are skilful bamboo shoots farmers. According to one former forestry official Mr. Wang comment, “The demonstration households thrive who have a scientific mind-set, entrepreneurialism, and courage to try new bamboo propagation methods, bamboo types and cultivation techniques (Interview with former forestry technician in Lin’an G01, 2012).” Demonstration households are used to “exhibit at government research stations to introduce new management technique of species” (Zhu, 1997, p.184). To demonstrate the state’s efforts in afforestation and in promoting bamboo production during the 1980s and 1990s, Lin’an’s county leaders, officials, and technicians have to use the demonstration households’ Lin’an dialect, which literally means to find the appropriate demonstration personnel.

> One demonstration household Mrs. Suen acclaimed:
>
> Most of the farmers in Lin’an are not well educated and they don’t believe any new technology and technique until they have seen the actual performance of the technologies. So, demonstration households play a crucial role to show how the new technique works in their fields. Once other farmers see that the demonstration household become rich, this will drive them to try new techniques and earn lots of money like us (Translated by author) (Interview with a demonstration household D03, 2012).

When asked about whether the role as a demonstration household will change his forest management practices and fertiliser usage or not, one demonstration household person Mr. Bian commented:

> As a demonstration household, I pay more attention to forest management including my awareness of chemical fertilisers' usages, water management, and applying pollution free production standards. For example, I understand that if I apply pollution free production standard in my bamboo shoots' plantation; I am protecting my buyers' health; therefore, I have the responsibility demonstrate my good practice in bamboo shoot cultivation (translated by author) (Interview with one demonstration household D05, 2012).

In fact, demonstration households encounter different challenges to encourage other farmers to adopt new cultivation technology and techniques. For instance, farmers who have a low education level may not have the interest to learn new technology or they may not be too conservative to accept new technique. One of the demonstration households Mr. Shao responded:

> There are four major challenges to become a demonstration household. First, most of the farmers were not well educated; they are sceptical to science and new technology. They may not have a strong incentive to learn from us. Second, farmers like to make comparison and they don't want to teach other farmers to get rich -- even the demonstration households. I called this ideology the 'little farmer economic mentality' (Xiaonong Jingji sixiang 小农经济思想).Third, most of the farmers will maintain look and see attitudes before trying the new techniques and technology. So, the diffusion of the new technique is time consuming. Fourth, the cost of technological extension can be costly. For instance, the material costs of the early shooting techniques are not affordable to all farmers (Interview with a demonstration household D06, 2012).

From the above comment, Mr. Shao mentioned the "little farmer economic mentality" and "look and see attitude" reflect the emotions of comparison and distrust among farmers; these may hinder the effectiveness of technological diffusion.

5.3.6 Farmers' co-operatives

The State Administration Industry & Commerce of the People's Republic of China (SAFIC) is based on the "Farmers' Professional Co-operatives Legal Document" (2006) to encourage individual farmers to initiate the establishment of the co-operatives. Until now, there are more than ten thousands farmers' co-operatives in China (SAFIC, 2013). There are three major roles of the bamboo shoots' marketing co-operatives in Lin'an County: (1) utilise the synergy effects among farmers in the co-ops to reduce the risks of market price fluctuation in bamboo shoot production, (2) facilitate farmers and economics units such as fertilisers' companies, bamboo shoot markets, and processors to collaborate with each other to protect farmers' interests, and (3) increase the scale of high quality of bamboo shoots' productions (see more in Chapter Six).

5.3.7 Farmers

Bamboo shoot farmers are at the grassroots level in the bamboo shoot governance system. They have strong bamboo cultivation experiences and artisan skills to produce and process the bamboo shoots including Moso bamboo shoots, *phyllostachys praecox*, *phyllostachys nuda*, and *phyllostachys vivas*. At a village level, farmers are bound into the network of villages and individual farmers will be organised into groups. Under the household registration system, farmers are registered as residents of the village and are entitled to lease the land provided that they use it. The rural committee runs the village, which "comprises the party Secretary, village head and deputy head and others including technicians and specialists" (Brown et al., 2008, p.57). In 2006, there were around "60,000 bamboo farmers" and "60% of their incomes" is derived from bamboo shoots' production, processing, and marketing (Ho, 2007, p.2).

According to Ho and Tang (2006, pp.2-4), there are approximately “50,000 bamboo shoot farmers,” “4,000 processing workers and 6,000 people” who participated in bamboo shoots’ logistics and marketing in Lin’an County.

5.4 Discussion of the critical policies to achieve sustainable development

After identifying the key actors in the bamboo shoot governance structure in Lin’an County, the following section is going to elucidate how the key forestry policies, have been implemented by the Lin’an County government, the forestry bureau officials and the non-state actors (e.g. farmers) to achieve the governance of sustainable development in the bamboo shoot production industry. These policies demonstrate the attempts of the Lin’an state and non-state actors to strike a balance between economic development and ecological conservation in bamboo shoot cultivation (see Table 12).

Table 12 Key Policies to Achieve Sustainable Development

Key policies		Critical events	Attempts to achieve sustainable development
Ten Years Forestry Development Policy	1982	Conducted Forest and Land Resource Survey to identify highest economic returns' bamboo shoots	Explored what specific types of bamboo shoots could bring the best economic potentials and be grown to overcome geographical constraints in mountainous Lin'an. Bamboo shoots cultivation became the major policy means to achieve the policy goals of "barren hills elimination, stabilisation of agricultural lands, and focus on bamboo shoot production". The ecological benefits of this policy to green the barren hills through bamboo shoot cultivation.
San Ding policy	1983	The Lin'an municipality launched the Household Responsibility System and contracted out bamboo plantation rights to individual. Forest was classified as family-owned plots, responsibility hill, and collectively-owned hills	Implemented the Forestland Responsibility System (FRS) to increase farmers' incentive to conserve and manage bamboo plantation. The delineation of the boundary of the forestry property provided two major benefits: first, decentralisation of land use right and right to derive income increased farmers' economic incentive and increase forestland productivity; second, it facilitated individual farmers' responsibility on bamboo forest's conservation.
	1984	Lin'an Forestry Bureau submitted the proposal *Bamboo and its further Development and Utilisation in Lin'an* to Lin'an County government. This proposal identified eight major ecological and socio-economic advantages of growing bamboo shoots	This proposal affirmed two major functions of growing bamboo shoots to increase mountain areas' ecological efficiency and increase farmers' economic returns.
Who grow who own policy	1985	The Lin'an Municipality adopted the proposal to developed 6, 667 ha of bamboo shoots plantations by contracting out rural collectives' slope lands and waste lands to individual farmers	Contracted out wastelands and slope lands for bamboo shoot farmers to use bamboo shoot cultivations to regenerate degraded slope. This brings the ecological values to solve the soil erosion problems and increase vegetation coverage.

Bamboo Plantation Supporting policies (1st subsidy for bamboo shoot producers)	1986	Launched the Bamboo Shoot Supporting policy by providing 100 million Yuan subsidy for bamboo shoot farmers to encourage them to grow bamboo shoots	Imbue farmers to choose productive bamboo seedlings and manage their forest skilfully the Lin'an Forestry Bureau provided 20 Yuan per 1.33 hectare (equivalent to 20 mu) as a subsidy to support bamboo shoot farmers to establish their bamboo shoot plantation between 1985 and 1988 (Xu, 2007, p. 29).
	1989	The Lin'an County government stipulated the directive of "using five years to eliminate barren hills and spending ten years to green Lin'an"	Emphasised the economic sustainability of bamboo shoot cultivation. The Lin'an Forestry Bureau started to provide technical extension services to bamboo producers and demonstration households in three major ways: in 1989. This directive was implemented in two major ways: (1) promoted the early-shooting techniques to multiply farmers' income and (2) promoted the new bamboo shoot cultivation techniques through extending the demonstration households' system and established the Lin'an Bamboo shoot production association.
Implemented World Bank Afforestation Project	1994	World Bank Afforestation Grant Loan	Afforested 18,500 Chinese fir, broad leave forests 150 hectares and Moso bamboo forest 675 hectares and rejuvenate 750 hectares low productivity Moso bamboo forest (Lin'an Forestry Bureau, 1994, p.18).
Provided subsides to the processing industries	1995	The Lin'an municipality provided 1.5 million Yuan to subsidy the shoots and culms processing industry Bamboo shoot cultivation land reached 6,930 hectare in Lin'an	Policy shift from subsidising bamboo shoot production to processing industry in order to achieve economic sustainability After building up the production base of bamboo, the Lin'an County government shifted it focus to provide more and funding supports for bamboo shoot processing industry.
Implemented Five Big Forest Policies	1996	The Lin'an Forestry Bureau implemented Five Big Forestry Policies to achieve the policy goal of "Comprehensive development and wealthy farmer with flourish forest"	This Five Big policies include: (1) the 1518 programme, (2) the World Bank afforestation programme, (3) emphasise the vertical and inter-industrial integration and market connections of bamboo shoot production, (4) forest resource protection, and (5) 100 kilometre green economic corridor development (Lin'an Forestry Bureau, 1994, p.18). Both the 1518 Programme and the World Bank Afforestation project caused a

			greatly increase of bamboo forestlands to “180, 000 hectares and contributed to 5.8% of the slope lands and wastelands’ conservation from 1995 to 2006” (Ho, 2007, p. 2).
(1)The implementation of Natural Forest Protection Programme (2) The Bamboo supply-chain Management and bamboo production tax policies	1997	(1) In 1997, The Natural Forest Protection Programme (NFPP) was launched in Lin’an County which aimed at banning logging and conserving natural forests (2) Institutionalisation of the bamboo shoot supply chain by issuing certificates and licenses for processors and transporters	(1) Farmers commented that the logging ban had limited influences on Lin’an farmers because of majority of farmers depend on bamboo shoot cultivation (2) The Lin’an County government issues certificates and licenses for processors and transporters to regulate the materials and economic flows. There is a preferential policy for cultivators and processors that bamboo cultivation and transportation will not have a tax charge; however, the 7.5% of the value-added tax will be charged for bamboo processors. The supply chain policy emphasised the processing and marketing of bamboo shoots.
The Model Forest Policy	1999	Lin’an County was invited to join the International Model Forest Network. The Lin’an state started the eco-tourism and launched the Natural Forest Conservation Project by growing NTFP include hickory, ginko and torreya grandis	The International Forest Model Network because of its “sustainable forest management” of bamboo shoot resources to transform Lin’an from a timber-dependent to a timber protection county. There is around 31, 2000 ha of forestlands in Lin’an was designated as a Model Forest in Asia (International Model Forest Network, 2014). The transition from timber-dependent to timber protection shows the tendency of ecological rationality of the Lin’an forestry.
Second stage of financial supporting scheme (1991-2003)	2001	The subsidies is targeted for large bamboo shoot producers to increase both the scale and quality of the bamboo shoot production	Lin’an Forestry Bureau subsidies’ provision was targeted on high-yield bamboo shoot producers

	2002	Lin'an County obtained the Smartwood Certificate	The state wood production farm in Lin'an County obtained the first forestry certificate – SmartWood Certificate in China through the verification of the Forest Stewardship Council (SFC) (Jiang, 2003, p. 23).
The policy of "develop economizing ecology, utilize cultural heritage, and further promote bamboo shoot cultivation"	2003	"One-year, Three-years, Five-years socio-economic development programmes	This programme aimed at promoting bamboo shoot cultivation to bring Lin'an County into a 'greening county' and achieve the vision of building a 'relatively wealthy society'. The Lin'an state co-ordinates the greening and economic development through bamboo shoot cultivation together in the 135 Programme, the Lin'an state aims at integrate the bamboo shoot greening plans into the economic development plan.
Third stage of financial supporting scheme (2004-2008)	2004	The Lin'an state increased the bamboo shoot industry's integration by providing subsides to dragon-head enterprises (state-supported leading enterprises)	The stage three subsidies' provision was on target on 'sophisticated bamboo shoots cultivation demonstration unit'.
Eco-forest policy	2005	Launched the "Eco-forest" construction project and two areas were designated as "Natural Conservation Areas" in Lin'an	Farmers could obtain ecological conservation compensation fund. The Lin'an state used subsidies to encourage farmers to conserve eco-forest.

The Moso Bamboo Forest Cutting Priorities Policy Pollution-free production standardisation policy	2007	Emphasised the construction of ecological forest (pollution-free shoots production) and the assessment of the forest management	Institutionalizing the regulations of the priority cutting influence the behaviours of bamboo shoot producers. The current stage, the state imbues the bamboo producers and processors to pay attention on ecological and product sustainability and bamboo shoot products' marketing.
Carbon trading of the bamboo production industry	2009	Signing the Lin'an Declaration with 21 mayors to develop bamboo forest into carbon forest project	Economising the ecological services of bamboo to sequestrate carbon dioxide to achieve sustainable development. This carbon bamboo forest project is last 20 years which has the potential "to produce 8,155 t carbon dioxide -e net carbon credits which will be traded in Huadong Forestry Exchange (HFX) (Zhu et al., 2015, p.83).

In an analysis of the critical policies during the reform period from an ecological modernisation perspective, we can observe a policy tendency towards institutionalising environmental practices and systemisation of bamboo resources' management. For instance, Lin'an implemented a logging ban, prioritised the cutting of moso bamboo timber and implemented the Model Forest's and Smartwood's sustainable forest practices. All these show the rationalisation of the management of bamboo cultivation to increase the forest coverage, fix soil erosion on the mountainside, and increase economic value. The Lin'an state also employed market instruments to price ecological services related to bamboo production, including carbon trading, collecting a green tax from bamboo culm processing and provided subsidies to encourage farmers and processors to increase the scale of production and improve the standards of bamboo shoot production.

From the perspectives of eco-Marxism and political ecology, greater concern is shown to the consequences of the pro-growth mentality and economic rationality that dominated in Lin'an forest policies. For them the conflict between the use value of bamboo shoot cultivation for conservation and the exchange value production of bamboo shoot for market sales matter greatly. According to Zhu (1997, p.182), the policies include the Ten Years Forestry Development Policy (1982) and Who Grow Who Own Policy (1985), which show the tendency of the Lin'an state to achieve the ecological and economic purposes in Lin'an County. The conflicts between use and exchange values of bamboo shoot cultivation widen when the Lin'an state appeals to farmers to adopt the 'early shooting techniques' to manipulate the seasonality and shooting performance of the *Ph. Praecox* bamboo shoot to earn a higher economic return. Bamboo shoot farmers were keen to adopt this technique to earn more money which caused a rapid increase in bamboo shoot productivity (73.5%) and production values (296.8%) between 1991 and 1995; while in terms of bamboo shoot cultivation areas, there was about a 15% increase (6,203 ha) of the total bamboo shoot cultivation areas between 1993 and 1994. From Figure 23, it is clear that the *Ph. Praecox* shoot production showed the highest percentage increase (88%) in total

tons of bamboo shoots produced between 1991 and 1995 when comparing it to dried *Ph. Nuda* (77%) and Moso (6.15%) bamboo shoot production. Both Figures 23 and 24 demonstrate a model of treadmill production in Lin'an bamboo shoot production system (Schnaibery, 1980). As the scale and intensity of bamboo shoot production increased there was greater removal of bamboo shoots (e.g. biomass) out of Lin'an's ecosystem; this resulted in greater inputs of fertilisers to refill the depleted soil and pesticides to stabilise the ecosystem (Schnaiberg et al*.,* 2000, p.16). The implication of remaking the bamboo shoot production system to sustain the accumulation of natural capital was that the Lin'an state and bamboo shoot farmers have treated the bamboo shoot system as a "tap" for more resources and "sink" for fertiliser and pesticide pollution (O'connor, 1998). Figure 23 shows that there is a large fluctuation in the productivity and production value of bamboo shoot cultivation between 2000 and 2008, which implies an ecological instability and vulnerability in the system (discussed further in Chapter Six). It is noticeable that the productivity of fresh bamboo shoots dropped by 28% though the production value was maintained in 2008.

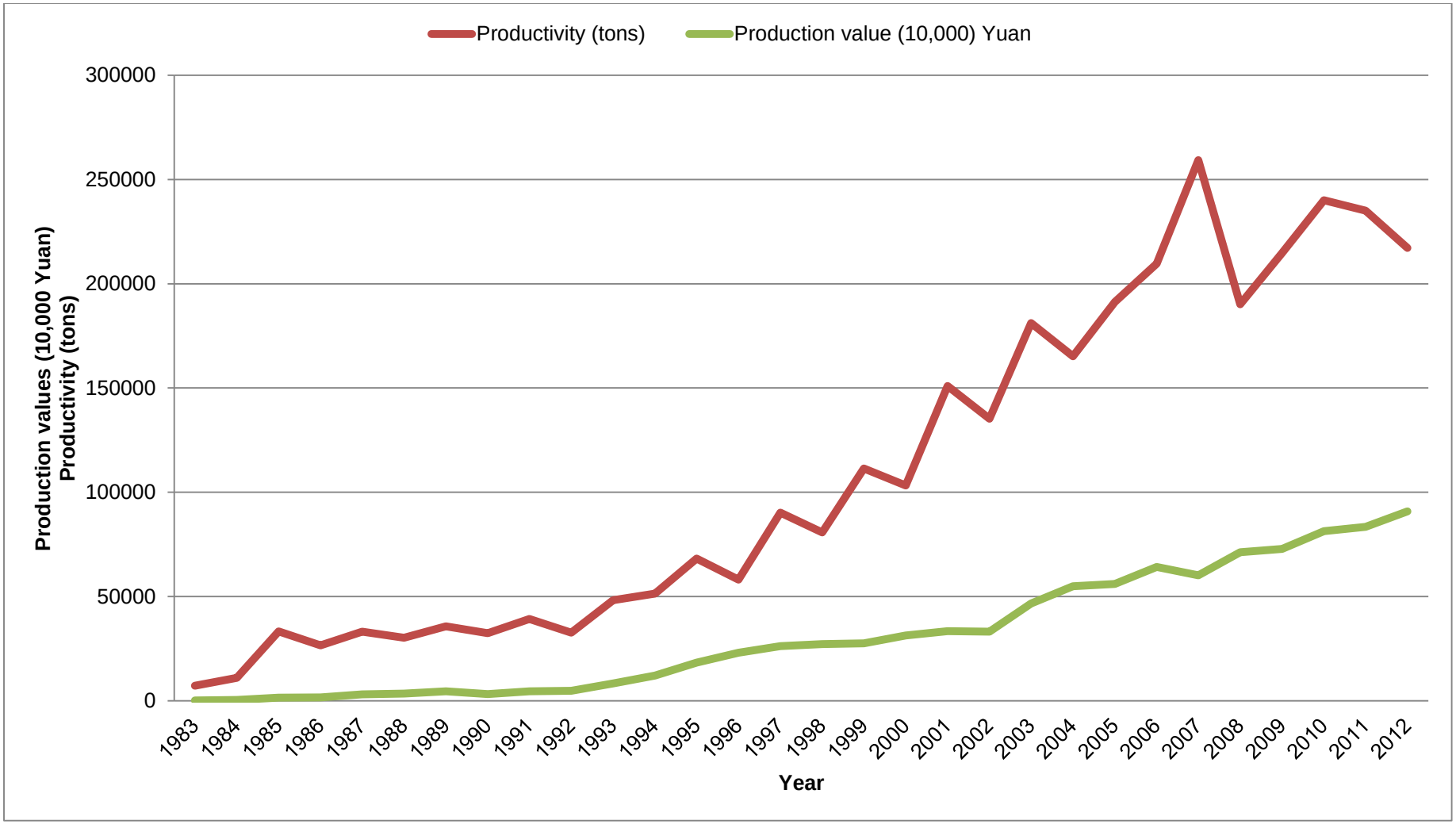

Figure 23 Productivity and Production Values of the Bamboo Shoot in Lin'an

(Source: Lin'an Forestry Bureau, 2012)

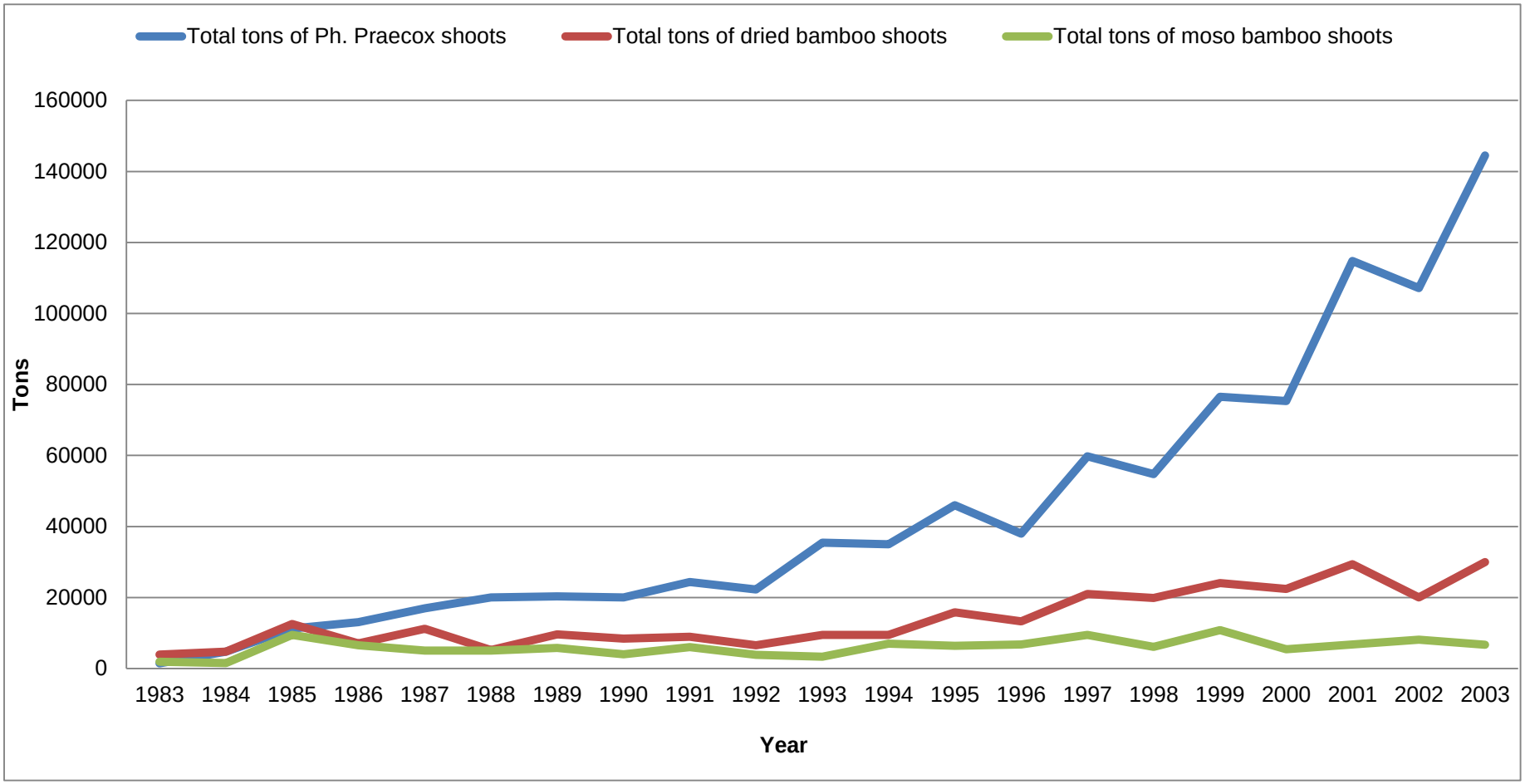

Figure 24 Total Tons of Bamboo Shoots Produced in Lin'an County

(Source: Lin'an Forestry Bureau, 2003)

5.5 Conclusion

This chapter stresses how Lin'an state pursues the governance of sustainable development in the bamboo shoot production industry through top-down axis co-ordination from the State Forestry Administration (SFA) down to County level state and Forestry Bureau. This chapter argues that the Lin'an state collaborates with non-state actors within a both state-centric and multi-nuclei governing structure to implement governing concepts, legal instrument, manage institutions and execute policies to achieve the sustainability of bamboo shoot production. By critically examining the governing concept, legal instrument and forestry policies in Lin'an, this research argues that Lin'an state is still prioritising economic sustainability before environment conservation though the local state shows the tendency of institutionalisation of environmental practices, regulating illegal logging, systemising bamboo shoot resource management. Since the 1990s the pro-growth economic trajectory has driven farmers to depend on bamboo shoot cultivation to afforest barren hills and increase material welling, particularly after the introduction of the early shooting technique in 1991. Since then, more bamboo shoots output was required to generate higher income for farmers to obtain additional material well-being. As a result, the intensity of bamboo shoot production needed to be increased; this resulted in greater inputs of fertilisers to refill the depleted soil and pesticides to stabilise the ecosystem; this widened the conflicts between use and exchange values of bamboo shoot cultivation. To explain how these conflicting values are widened, Chapter Six examines how Lin'an state and non-state actors strike a balance between (1) the profitability of using the early shooting technology and (2) the promoting of cleaner way of production across different actors. The former is to achieve through Forestry Bureau's technological extension and the latter is to manage through research institutions' and farmers' co-operatives' technological support and organic fertilisers provision. Chapter Seven elucidates how Lin'an state

strategically increase the industry integration and enhance the exchange value of bamboo shoot cultivation through processing sectors and employ the demand side of suppliers to regulate the production standards of bamboo shoot farmers. The local state aims at using the industry's integration to absorb over-produced bamboo shoots, increase production standards and maintain the sustainability of the bamboo shoot industry.

CHAPTER SIX: MANAGING THE BAMBOO SHOOT PRODUCTION SYSTEM

6.1 Introduction

The preceding chapter examines how the Lin'an state pursues the governance of sustainable development in the bamboo shoot production industry through top-down axis co-ordination from the State Forestry Administration (SFA) down the County level state and Forestry Bureau. This Chapter examines how the local state and non-state actors interact in a horizontal axis of governance to strike a balance between (1) the profitability of using the early shooting technology and (2) the promotion of "hazard-free production standard" (cleaner way of production) to achieve sustainability. There are two major arguments in this chapter: first, the local state dominates the promotion of the early-shooting technology to multiply farmers' profits; however, this technology created a cycle of boosting bamboo shoots' productivity by the overuse of fertilisers and pesticides, which results in degrading farmlands. Since the 2000s, soil degradation has exerted a growing pressure on the local state and Forestry Bureau to modernise the bamboo shoot production system through the standardisation of fertilisers and pesticide usage and technological fixed techniques including soil-cleaning, re-arrangement of the plantation structure, using organic fertilisers and replanting. The modernisation of bamboo shoot production prompts this research to ask whether the hazard-free production standards effectively reorient farmers' unsustainable practices?

Second, this chapter argues that the Lin'an state extends its indirect rule on promoting the cleaner way of production through the collaboration with farmers' co-operatives, demonstration households, and research institutions. These organisations extend the arm of state in multi-nuclei forms to control the

standards of the bamboo shoot production, fill the gap of government policies and take advantage of the economics of scale. Both state centric and multi-nuclei governing structures co-exist to achieve the state's green and economic project; this drives us to question whether this state-driven bamboo shoot production model can achieve sustainability in rural Lin'an.

To answer these two questions, this chapter is divided into five sections. Following the introduction, section two engages the debates of ecological modernisation, eco-Marxism and political ecology to discuss the role of the Lin'an state to promote the early shooting technology to achieve sustainability in bamboo shoot production. Section three elucidates how the Lin'an state collaborates with research institutions, demonstration households, and bamboo shoot farmers to promote the cleaner way of bamboo shoot production. Section four addresses how the Lin'an state interacts with one fertiliser and one bamboo shoot co-operative to execute the hazard-free production standards through trust making and local social networks. Chapter five is the conclusion of this chapter.

6.2 Debates on the role of state and technological fixes

To contextualise the bottom-up implementation of sustainable development policies in Lin'an County, this research argues that the perspectives of ecological modernisation, eco-Marxism and political ecology provide significant insights for this research to capture the role and steering approach of the local state to co-ordinate local institutions and farmers to promote early shooting technology and hazard-free production standards.

In the analysis of the steering approach and institutionalization of production standards from an ecological modernisation perspective, ecological

modernists are concerned as to how the Lin'an state collaboration with private institutions to institutionalise production standards to manage bamboo shoot resources (Mol 2006; Ho 2006). Particularly, addressing how the Lin'an state establishes bamboo shoot production standards to insure better quality and safety of the bamboo shoot production processes. Through a win-win rationality the best use is made of institutionalisation of production standards, human capital (labour, artisan skills and culture), and public-private partnerships to solve both economic and environmental problems in the bamboo shoot production industry (Economy, 2006). In so doing, the approach of ecological modernists is to consider the effectiveness of the public-private partnerships and hazard-free production standards to mitigate and rehabilitate the side effects of bamboo shoot production in Lin'an County (Bai et al*.,* 2007; Boström and Klintman, 2006, p. 165). Additionally, ecological modernists help this research by questioning whether new technology can help Lin'an County to increase its governing capacity to re-orient farmers' unsustainable cultivation practices to a cleaner production of bamboo shoots. For instance, understanding how the Lin'an state collaborates with farmers' co-operatives and research institutions to deliver the hazard-free production standards, soil-cleaning, and forestry restructuring technologies for the bamboo shoot farmers to mitigate soil degradation.

However, eco-Marxists are doubtful about the implementation defects to the steering approach of the local state and the role of technological-fixes to tackle the sustainability problems. Particularly, eco-Marxists question which partnerships among the Lin'an state, co-operatives, and research institutions obtain the largest benefits from the bamboo shoot production and leave the environmental harm for Lin'an farmers (Tilt, 2010; Wainwright, 2013; Wesoky, 2012). Additionally, political ecologists also question whether the public-private partnership will become the state's governing tool to transform resource users' behaviours and extend state control to absorb more social capital and labour of

Lin'an farmers, which may result in limited farmers' participation and environmental deterioration (Ferguson 1990; Tilt, 2010; Blaikie and Muldavin 2004; Yeh 2009). Regarding the role of technological fixes, both eco-Marxists and political ecologists question the domination of exchange values and anthropocentric perceptions of bamboo forests embedded in Lin'an state and non-state actors' mind-sets will affect the efficacy of using technology to tackle the soil degradation problem because environmental victims have unconsciously adapted to the degraded environment in their daily experiences and they may not have the authority or desire to use clean technology to change their ways of living (Wainwright, 2013; Tilt, 2010).

Situating the above debates on the steering approach, institutionalisation of production standards and technological fixes among ecological modernists, eco-Marxists, and political ecologists, this research is going to explore the ways of the Lin'an state may promote early shooting technology to achieve economic and environmental sustainability in the following section.

6.2.1 Role of Lin'an State to Promote Early Shooting Technology

The early shooting technology is a policy response to transform bamboo shoot cultivation from a backyard gardening (use value) to market gardening (exchange value) but also to economise bamboo shoot cultivation in response to market signals. This technique creates speculation opportunities for farmers to invest in buying fertilisers, soil-covering materials, and input their labour to manipulate the shooting period of bamboo shoots before the Lunar New Year to multiply their incomes. For instance, the Lunar New Year in 2009 was on the 26th January; the average price of the early shooting fresh *Ph. Praecox* shoots was sold at 13.28 Yuan per kg in January; while the normal shooting *Ph. Praecox*

shoot were sold 0.95 Yuan in April (Lin'an Forestry Bureau, 2010). Figure 25 indicates the productivity of the early shooting *Ph. Praecox* shoots is lower than the natural shooting *Ph. Praecox*; however, the production value is much higher than the natural shooting *Ph. Praecox* shoots. For instance, in 2008 the production value of the natural shooting *Ph. Praecox* shoot comprises 1/3 (25.6%); while the early shooting *Ph. Praecox* shoot comprises 2/3 (74.4%) of the of the total production value (see Figure 25). Both the Lin'an state officials and farmers realise the market potential of bamboo shoot consumption cultures for festive culinary practices, gift exchanges, and for showing their social status during the Lunar New Year. Particularly, the people in Zhejiang, Ningbo, Shanghai, and Jiangsu provinces celebrated their Lunar New Year with lots of bamboo shoots, meat and vegetable cuisines. According to the market mechanism, fresh vegetables are scarce in early spring and there is a huge market demand in urban areas for fresh vegetables including fresh bamboo shoots. If bamboo shoot farmers can produce bamboo shoots to meet the market demand, they can earn a decent income. Owing to huge economic values in fresh bamboo shoot production, the early shooting technology was widely endorsed by the Lin'an state and Forestry Bureau because of its high profitability, short production cycle, and high applicability to the villages in Lin'an County. In 2003, there were around 65,000 bamboo shoot farmers who earned more than 5,000 per capita income annually which accounted for 60% of the total 108,000 agrarian population in Lin'an, since most of the high income farmers adopted the early shooting technology (He, 2004, p.1).

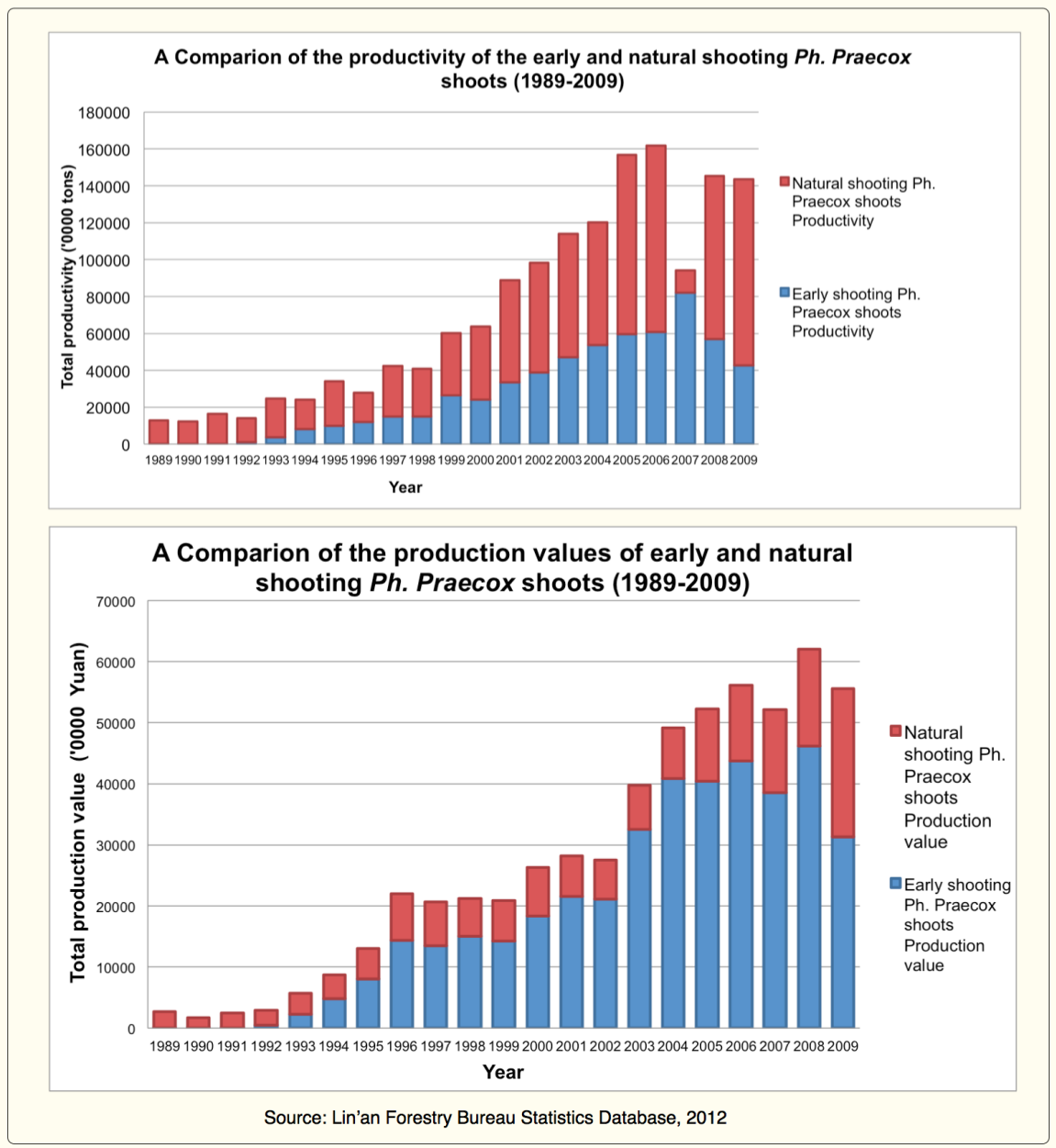

Figure 25 A Comparison of the Productivity and Production Values (Source: Lin'an Forestry Bureau, 2012)

The Lin'an state harnessed the governing concept of building a relatively wealthy society and maintained control over the policy design and implementation of promoting the early-shooting technology to multiply farmers'

incomes. The application of such controls was to influence the decision-making processes at the village level. The following quote provides supportive insights:

> All levels of the government officials in Lin'an County had to unify the understanding and action on using bamboo shoots cultivation for achieving conservation, obtaining economic benefits, and steering for rural prosperity. The Communist Party and Party members had to become demonstration households in the village to promote the ideology of building a relatively wealthy society. The core members of the Party had to formulate decisions with the village heads to mobilize the whole village to take action [Translated by author] (Lin'an Bamboo Shoot Industry Association, 1989b, p.2).

From the above quote, the Lin'an state had supervised and guided the county, township, and village levels of state actors to promote the early-shooting technology. In so doing, the township level government officials would help Forestry Bureau's technicians to meet communist party cadres and village committee members in appropriate villages. Once forest technicians met with the village head and party cadres, basic cultivation lessons and technical descriptions of the early shooting technology would be provided. Once the village head and secretary of the communist party accepted to promote this technology to their village; mostly the communist party cadres at that village had to take the lead to become the demonstration households and promote the early shooting technology first. Figure 26 shows the communist party cadres and village head in Qing Yuen village in Taiwuyuen Township, receiving trainings to promote the early shooting technology to become demonstration households.

Figure 26 Training for Communist Cadres and Rural Committee Members (Source: Author's collection)

In fact, the County government and Forestry Bureau controlled the promotion of this technology. There is no status quo in decision-making between the county and village level of government in the hierarchy. Instead, the county level of government officials upholds higher decision-making authority on bamboo resource planning and bamboo shoot promotion programmes; the village level government officials had to take action to promote the early shooting technology. Once potential demonstration households had been identified, the forestlands were to be cleared for *Ph. Praecox* bamboo shoot cultivation. The forest technicians would instruct demonstration households to follow specific propagation and cultivation procedures. For instance, the technique of early shooting technology suggested clear steps of tilling the top soil, watering levels,

preparing seedlings, nurturing mother stalks, and covering materials' preparations (Lin'an Bamboo Shoot Industry Association, 1990, p.1).

6.2.2 Forestry bureau officials influence individual farmers' decision making

Most of the time, forestry technicians collaborated with demonstration households to provide on-site instructions and report the profitability in applying the early-shooting technology. Although farmers have the autonomy to make decisions on what to grow and how to plant their forest resources, the forestry technicians use the narratives of demonstration households and high value added potentials of early shooting technology to persuade bamboo shoot farmers to grow *Ph. Praecox* shoots and apply early shooting technology. Figure 27 indicates how a demonstration household Mr. Shao, on the left who wore a green-stripe T-shirt, taught other bamboo shoot farmers about his knowledge and experiences to get wealthy after applying the early shooting technology.

Figure 27 Demonstration Household of Mr. Shao Sharing his Experiences
(Source: Author's collection)

The experiences of demonstration households pinpointed how they became rich after applying the early shooting technology. The forest technicians

and the Communist cadres in the villages mostly adopted the storytelling tactic by informing farmers about the success of the demonstration households after applying this technology. Particularly, Mr. Bao Zi Chao's story was told extensively by forestry official concerning the success of applying early shooting technology to become rich after he became a demonstration household:

> In 1990, Mr. Bao managed 0.025 ha of the bamboo forest garden in San Kou Village and he sold 1070.25 kg of fresh *Ph. Praecox* shoots and earned 4,165 Yuan by using the early shooting technology. It was translated into one mu [0.15 ha], the total profit was 11,025 Yuan. Mr. Bao was the earliest farmer who sold bamboo shoots in the market, one month earlier than his peer farmers. Under the scarcity economic principle, the earliest shooting implied the highest price advantage because there was a huge market demand with limited supply [Translated by author] (Lin'an Bamboo Shoot Industry Association, 1990b, p.3).

The quote is part of the narrative that emerged from the late 1980s of a farmer becoming wealthy. Here the quote appeals to farmers that they can take two major actions: first, it imbues farmers to adjust the shooting period so that it works with the market signal; second, the quote also educates farmers to utilise a small plot of land even smaller than 0.025 ha, can earn more than 10,000 Yuan per year. The presentation of the application of the early-shooting technique emphasised the transformative power on a demonstration household as it moved from poverty to a prosperous future.

Table 13 The Bamboo Shoot Cultivation Record of Mr. Bao

Date	Quantity in kg	Price per shoot	Total profit in Yuan
16/2/90 – 9/3/90	280. 5	$3. 56	$2, 047
10/3/90-7/4/90	789. 75	$0. 81	$2, 118
Total	**1070. 25**	**$3. 95**	**$4, 165**

Note. The above statistics were obtained from the Lin'an Bamboo Shoot Industry Association, 1990b, p.3.

From the statistics in Table 13, Lin'an forestry technicians used Mr. Bao's story to convince other bamboo shoot farmers in Lin'an to apply the early shooting technology. As Edmunds and Wollenberg (2003, p.156) argue the indirect rules of Chinese state are invisible tools of control on influencing forest users' decision making. A prosperous and productive bamboo shoot plantation not only achieves the county directive to help farmers to become relatively wealthy but also strengthens the indirect rule of the Lin'an state to influence the decision making of individual farmers in considering the management techniques[30], profits' calculation, and responses to market demands. Apart from using the successful story of demonstration, the Lin'an state also uses the training workshop to educate farmers to adopt the early shooting technology.

[30] These management technique include select the appropriate amount of fertilisers and water, provide endeavour in managing soil drainage, pests control, and density of bamboo forest, and carefully applying covering materials in the fields.

6.2.3 Farmers' decision making through knowledge transfer

To convince bamboo shoot farmers to adopt the early-shooting technology, the Lin'an Forestry Bureau collaborated with Lin'an Modern Technology Centre (LMTC), China Forestry Research Institute of Subtropical Forestry (CFRISF), and the Zhejiang Agricultural and Forestry University (ZAFU) to provide training workshops (see Figure 28), co-author the production standards, guidelines and procedures of the early shooting technology, and publish in a booklet for bamboo shoot farmers in Lin'an County.

Figure 28 Farmers Receiving Early Technology Production Training
(Source: Author's collection)

In the training workshop, farmers would be educated in the knowledge about the physiological conditions, market segment, covering materials, and

techniques of applying the *Ph. Praecox* shoot technology. For instance, the forestry technician imbued farmers with the knowledge of high-value and low-value market segments for the fresh *Ph. Praecox* shoot market and how to use covering materials and fertilisers to control the shoot period of *Ph. Praecox* shoots to reach the high-value market segment (see Figure 29).

Figure 29 A forestry technician educating farmers about market segment
(Source: Author's collection)

For the high-value market segment, early shooting *Ph. Praecox* shoots can be provided in the off season in winter and spring; while market demands are very high. By adding covering materials and plenty of fertiliser to manipulate the

shooting period of *Ph. Praecox* shoot from mid-March to earlier February they will meet the high market demand (see Table 14).

Table 14 Inputs of Covering Materials to Produce the Early Shooting Effect

1.	The total shooting period of *Ph. Praecox* shoots	Approximately 66 days (from 1st February to 7th April)
2.	The early shooting period of *Ph. Praecox* started	From 1st February to 28th February
3.	Four major chemical fertilisers inputs in a year	Urea fertiliser 130 kg Sulphur fertiliser 50 kg Potassium fertiliser 15 kg Lime fertiliser 500 kg
4.	Total organic fertiliser (human and chicken deposits) in a year	6,000 kg
5.	Covering materials (e.g. bamboo leaves, rice husk and chicken deposit) to increase soil temperature by 20 ºC	Bamboo shoot farmers have to input 25 centimeter of covering materials

Source: Lin'an Bamboo Shoot Industry Association, 1991c, pp.1-2

To produce the early shooting effects of the *Ph. Praecox* bamboo shoots, there are six major steps to increase the soil temperature and fertility by adding plenty of covering materials including rice husk, wheat straw, and chicken deposit (see Figure 30). These covering materials increase the soil temperature by 20 ºC and create a blanket effect to bring forward the crop approximately 45 days earlier than normal shooting days.

1 Bamboo shoot farmer prepared rice husk and wheat straw to cover the soil

2 Chicken deposit is used to increase the fertility and temperature for fermentation

3 Cleaning up the Ph. Praecox bamboo shoot cultivation lands and tilting will be applied

4 Bamboo shoot farmer mixed all covering materials with chicken deposit and used this material on his bamboo shoot cultivation lands

5 The covering materials increase the temperature and create a blanket effect

6 The Ph. Praecox shoot came out from the sil soil surface in early Feburary

Figure 30 Steps to Apply Early Shooting Technology

(Source: Author's collection)

6.3 The environmental challenges of using the Early Shooting Technology

The major problem of the early shooting technology was to manipulate the seasonality of the shooting performance and it sought to do it in two major ways: (1) add covering materials to create a blanket effect to increase soil temperature and (2) boost the soil productivity by adding chemical fertilisers. Both practices will increase the salinisation, chemical accumulation, and occurrence of pests and diseases if the farmer misused the fertilisers and mismanaged the cover materials (Chen and Xiao, 2005; Lu and Chen, 2009; Lu et al*.,* 2010; Yu et al*.,* 2003).

Although farmer households' incomes can be increased five to ten times, prolong materials' of fertilisers and covering materials use many cause extensive areas of farmland to become degraded; this "aroused higher level government and public concerns" (Ho, 2007b, p. 1). Relentlessly using large amounts of fertilisers caused soil degradation in Lin'an *Ph. Praecox*'s bamboo forest comprising both 5,100 hectare (26%) of low productivity praecox shoot production lands and 5,050 hectare (26%) of degraded praecox shoot lands out of the total 20,266 hectare of praecox shoots in Lin'an County between 2005 and 2006. Among total degraded praecox land areas, there are totally 70% of those degraded land areas which are medium or high degraded lands (see Table 15).

Table 15 Degradation Level of the *Ph. Praecox* Bamboo Forestlands

Low level	30%
Medium level	35%
High level	35%

Source: Ho, 2007b, p. 1

To understand how bamboo shoot farmers perceive the problem of early shooting technology, this research also conducted a survey with 56 bamboo shoot farmers to understand the major reasons that cause soil degradation on farmers' farmlands. The vast majority of farmers (80.4%) reported that overusing of chemical fertilisers in early shooting technique is the major reason to cause soil degradation. According to Wang et al (2007), there were approximately 5,133 hectares of farmlands in Lin'an County which suffered from soil degradation after applying the early shooting technology. Following up in-depth interviews with bamboo shoot farmers showed considerable insight into the relationships between environment and economy provided further explanations for soil degradation in Lin'an.

Mr. Xu, who has been growing *Ph. Praecox* shoot more than 15 years, commented:

> Using the early shooting technology is aiming for money. I have to put lots of fertilisers and cover materials to let the shoot comes out earlier. However, the covering technique increases the pests and diseases because of over-using fertilisers. If there is no fertiliser application, the shoot will not come out easily (Interview with bamboo shoot farmer F03, 2012).

From Mr. Xu's comment, he was struggling between economic interests and forest conservation. The more fertilisers he used, the more pests and diseases problems he reported (e.g. bamboo plight, culm base rotting and leaf spots).

Another bamboo shoot farmer Mr. Yu, who has been growing *Ph. Praecox* more than 20 years commented, "The soil is seriously degraded because of relentlessly applying fertilisers into the soil. The soil structure was destroyed. I don't know what I should grow next? " (Interview with bamboo shoot farmer F08, 2012). From Mr. Yu's comments, most farmers have overused

fertilisers to boost the productivity, which resulted in soil degradation. To further understand how most farmers overused chemical fertilisers in the early shooting technology, this research conducted an in-depth-interview with a bamboo shoot cultivation expert, Dr. Chen at the China Forestry Research Institute of Subtropical Forestry (CFRISF):

> Overusing of chemical fertilisers is the main causes of soil degradation result in organic matter reduction, soil toxicity, proportion of nutrient instability, and poisonous chemical substances' accumulation in the soil. Human exposure to poisonous chemical substances such as nitrite and nitrate will increase health risks through drinking water and vegetable consumptions [e.g. bamboo shoots]. For instance, reduced oxygenation of haemoglobin (methmoglobinemia), abnormal fetus development and cancer (Interview with bamboo shoot expert E01, 2012).

A further problem is the inferior quality of fertilisers in the Lin'an fertiliser market. These fertilisers have lots of impurities with wood debris and sand, and the proportion of chemical substances was unbalanced. Mr. Chen, who has grown *Ph. Praecox* bamboo shoots more than 20 years commented:

> I estimate 50% of my lands are degraded. Farmer don't know the quality of the fertiliser until applied on their fields. Approximately 50% of the fertilisers are fake or fraud. Lacking a supply of organic fertilisers also caused the soil degradation. We know that organic fertilisers are better but don't have enough fertilisers from animal farms or households nowadays. This is the complementary role for different agricultural activities in the rural areas (Interview with bamboo shoot farmer F13, 2012).

From Mr. Chen's comment, he is sympathetic to the Lin'an model of using fertilisers and covering materials to adjust the shooting period of the *Ph. Praecox*. Additionally, he also commented the complementary relationships between the husbandry farming and forestry sectors; animal wastes from the husbandry farming can provide organic fertilisers for the bamboo shoot production industry.

Another farmer Mr. Xiao, who has grown *Ph. Praecox* shoots more 20 years, commented:

> If I can speak to the government, I would like to say two major things: (1) the government should combat those inferior fertilisers in the market. Those inferior fertilisers come from other provinces. These fertilisers not only are ineffective but also cause the soil to become toxic, (2) the pesticides usages in the bamboo shoot cultivation should be regulated because of the farmers' lack of knowledge on the pesticide usages (Interview with bamboo shoot farmer F06, 2012).

From Mr Xiao's comment, the early shooting technology not only produced soil degradation problems but also informed on the relationships between pest and disease problems and pesticide usages. According to Zhu and Yang (2006, p.29) the increase of the bamboo shoot cultivation areas from 26, 070 ha in 1983 to 55, 800 ha in 2003 in which 76.7 % of the total hectare of the bamboo shoot type is *Ph. Praecox* bamboo shoots. The monoculture of *Ph. Praecox* shoots increased the risk of pests and diseases in the Lin'an bamboo forest. The remedial measure for local farmers to stabilize the bamboo ecosystem and ameliorate the pest and disease problem is to use pesticides. This not only causes the bioaccumulation of toxins in the food chain but it also causes cyanobacteria bloom when pesticides run-off from the field into the nearby river in Lin'an (Ni et al., 2012).

6.3.1 Ways to address the problem of soil degradation

The Lin'an state recognised that the application of chemical fertilisers and pesticides in the early shooting technology accelerated soil degradation. Although soil degradation in *Ph. Praecox* bamboo farmland is the major concern, the Lin'an state did not see it as an environmentally limiting factor, rather identifying sufficient technology and increasing governing capacity (e.g. bamboo

shoot standardisation) to fix the soil degradation problem. The Lin'an state implemented two major policy measures to modernise the early shooting technology: first, establish the hazard-free production standards to control the amount of fertilisers and pesticides usages in early-shooting technology. Second, collaborate with the research institutions to shape farmers' management decisions to reduce fertiliser and pesticide usages. Each of these policy measures is discussed further:

To establish hazard-free production standards in early-shooting *Ph. Praecox* shoot production, the Lin'an Forestry Bureau collaborated with Zhejiang Agricultural and Forestry University (ZAFU) and the China Forestry Research Institute of Subtropical Forestry (CFRISF) to establish a research platform to produce sustainable *Ph. Praecox* shoot production techniques. On the one hand, the ZAFU conducted research on increasing bamboo productivity and minimising the side effects[31] of the early shooting technology. On the other hand, the ZAFU worked closely with the Lin'an Forestry Bureau to educate farmers about the proportion of fertilisers' applications, thickness of covering materials, and the proposal of a fallowing period for *Ph. Praecox* shoot cultivation. The Research Institute of Subtropical Forestry Research (RISFR) work focuses on sustainable[32] bamboo shoot production technique and the *Ph. Praecox* Shoot Plantation's Soil Degradation Amelioration Technique was applied. This technique was applied and adopted by the Lin'an Forestry Bureau in 2006. According to the bamboo

[31] These side effects include flowering, genetics changes and soil deterioration, which influence the productivity of bamboo shoot production.

[32] To facilitate the diffusion of innovative bamboo researches and technique applications among central, provincial, county, and township levels of research institutions, private firms, and forestry agencies, the RISFR organised Bamboo Congress with the Chinese Forestry Society Bamboo Sub-division yearly. There were 127 papers presented in the Bamboo Congress in 2013 covering the areas of physiological condition of bamboo (31 % of papers), bamboo propagation and conservation (32 % of the papers), bamboo material processing and utilisation (17 % of papers), bamboo for culture and ornamental purposes, (8 % of papers), and bamboo industry development prospects and policies (12 % of papers) (Bamboo Congress Proceeding, 2013).

shoot cultivation expert Dr. Chen at the China Forestry Research Institute of Subtropical Forestry (CFRISF) he commented:

> Our institute focuses on technology applications…especially emphasising how bamboo technologies create economic and social impacts toward farmers. Currently, we have to tackle the problems of soil degradation after prolonged bamboo shoot cultivation and we collaborated with the Lin'an Modern Forestry Centre [private firm] to test the techniques to ameliorate soils acidity and pollutants after intensive bamboo shoot cultivation. These techniques were applied through our demonstration households in Lin'an. Most of the time, I had to travel to Lin'an County and monitor the changes of soil conditions (Interview with bamboo shoot expert E01, 2012).

In fact, the Lin'an state extends its policy influence through local institutions which include ZAFU and the CFRISF to promote (1) Sustainable Bamboo Shoot Production Technique and (2) *Ph. Praecox* Shoot Plantation's Soil Degradation Technique to re-orient farmers' unattainable practices of overusing fertilisers and pesticides. These two techniques emphasise four major sustainable practices: First, rationalise the types, quantities, and durations of fertilisers; be aware of the proportion of Nitrogen (N), Phosphorus (P) and Potassium (K) in the soil through the "soil testing and fertiliser matching mechanism." Second, standardise the production procedures of bamboo shoots production from choosing the location of bamboo shoot plantations (e.g. without water pollution and severe air pollution); thickness of the covering materials should be between 20 to 25 cm, the maximum capacity of bamboo stalks and should be 800 per 0.06 hectare and 20% of the mother stalk should be preserved. Third, encourage farmers to substitute and reduce toxic chemical pesticide usage with biological ways of pest prevention. For instance, the Forestry Bureau installed 150 UV-light lamps in six major bamboo shoot production demonstration villages in Taiwuyuen Township to promote biological ways of pest control. Fourth, promote the standardisation of fertilisers and institutionalise pesticide practices. For example, demonstration households have to follow the forestry technicians' guidelines to rejuvenate their degraded soil by four major soil restoration techniques (see Figure 31) and follow

the hazard-free production standards to apply the allowable types[33] and dosages of pesticides. The Lin'an Forestry Bureau also produced and distributed a Sustainable *Ph. Praecox* Shoot Management booklet to illustrate the steps for bamboo shoot farmers to adjust the density of their bamboo plantation, record their fertiliser application schedules, rationalise their production procedures, and adopt the allowable types of pesticides to control pests and disease (see Figure 32).

[33] According to the hazard-free production standard (DB33 / 333.3-2006), since 2006 there are nine types of pesticides have been regulated in hazard-free production standards in growing *Ph. Praecox* bamboo shoot production (Xu et al., 2008, p.132)

1 Adding new soil layer

Adding 6 to 10 centimetre of new soil after four years application of the early shooting technology. Some farmers even grow leguminous plants to increase the carbon fixation process in the soil

2 Rejuvenating soil through digging and ploughing

Ploughing up the bamboo shoot lands to around 30 to 40 centimetre. Digging out old bamboo culms and roots but maintaining 300 / mu new and strong bamboo (1-2 years old) to transform the bamboo shoot forest

3 Infilling oragnic fertiliser

Ploughing up the soil by adding 200 kg of organic fertilisers

4 Replanting and redeveloping

Digging up all the bamboos and deep plough the soil for more than 50 centimetre and add 300 kg of lime

Note. Information is derived from "The Sustainable Ph. Praecox Shoot Production Standard Booklet 2012". Image credit by the author.

Figure 31 Four Major Soil Restoration Techniques

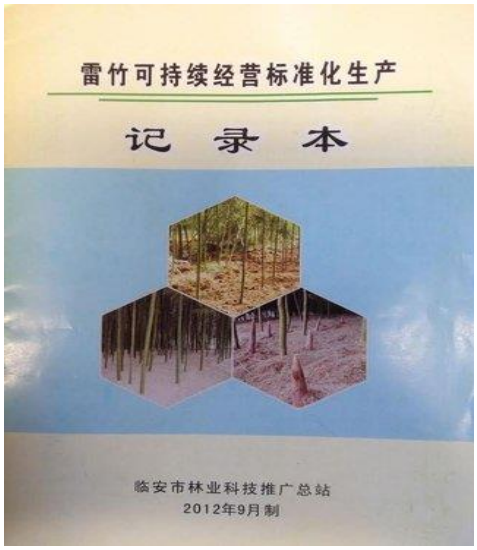

Figure 32 Sustainable *Ph. Praecox* Shoot Production Standard Booklet

Despite the Lin'an state playing an active role to influence farmers to adopt the soil restoration techniques, to a certain extent the soil degradation problem develops moral concerns for part of the bamboo shoot farmers because environmental degradation was directly connected with their economic interests and relationships with the environment. To understand their moral concerns to the environment, this research conducted a survey with 56 farmers and one of the questions was asked, "Who plays a higher role to protect the forest environment and reduce the soil degradation?" More than half the farmers (56.9%) commented that farmers play the highest role and nearly 41.2% of farmers think that government and villagers' committees also play a strong role to protect the forests. A follow up in-depth interview with bamboo shoot farmers provided considerable understanding into the relationship between environment degradation and moral concerns of bamboo shoot farmers.

Mr. Wu who became concerned about the protection of forests for next generation commented; "Now I am around 60 years old. I should take into account the next generation; otherwise, its young people cannot use the forest resources" (Interview with bamboo shoot farmer F12, 2012). From Mr. Wu's comment, he is concerned about the interests and environmental ethics of future

generation to use the bamboo resources. Therefore, the soil degradation problem raises his moral concern.

Another Farmer Mrs. Chen was concerned about her economic interest on forest resources to generate income commented, “I would like to protect because I have to depend on water and a mountain to derive a resource to generate income (靠山吃山，靠水吃水); the forest is my property. When I am conserving it, I am protecting my rights to keep generating money, therefore forest protection is to maintain my livelihood” (Interview with bamboo shoot farmer F17, 2012). From Mrs. Chen’s comment, she maintains economic rationality to protect the forests because she pays more attention to material interests from her bamboo forests.

Mrs. Chen, who was concerned about the relationship between environment and health commented, “The mountain provides different services for our people such as healthy life, fresh air and living water. Every day, I drink the water and breath the air from the mountain, thus protecting the forest provides a better living environment which is good for my health” (Interview with bamboo shoot farmer F17, 2012). From Mrs. Chen’s comment, the natural environment provides different ecological services particularly the forest ecosystem provides fresh air and better water quality to maintain the vitality of his health which drives him to be concerned about the environment in Lin’an.

Mr. Jiang, was concerned about the aesthetic values of the environment and commented, “I must protect the forest because the beautiful mountains can attract more tourists to come to our farm to stay [bread and breakfast] to visit. If we protect the forest, it will reduce the soil erosion and maintain a beautiful environment for our visitors” (Interview with bamboo shoot farmer F22, 2012).” From Mr. Jiang’s comment, he is concerned about the sustainability of the

ecological services (e.g. beautiful scenery) and economic development (e.g. eco-tourism) of Lin'an forest ecosystem.

From the above comments, we can see that soil degradation has become a public concern and it arouses the attention of both the state officials and bamboo shoot farmers. The following section is going to elucidate how the Lin'an state collaborates with farmers' co-operative and demonstration households to promote the hazard-free production standards and soil restoration techniques to achieve sustainability. By forming a partnership with co-operatives and demonstration households, this extends the arm of state in multi-nuclei forms to influence farmers to fulfil the bamboo shoot production standards.

6.4 Collaboration with co-operatives to extend the arm of the local state

This section examines how the Lin'an state extends its direct and indirect rules on promoting the hazard free production standards through the collaboration with farmers' co-operatives and demonstration households. For direct rules, both the Lin'an state and Forestry Bureau have the authority to control the production of bamboo shoots and activities of farmers' co-operatives through the forest law (discussed in Chapter 5) and farmers' co-operative law[34]. Additionally, the forestry bureau provides technology extension services and monitors the production quality of bamboo shoots from individual farmers and co-operatives. In so doing, the Lin'an forestry bureau established 50 testing points throughout the County to monitor the quality, heavy mental content, and chemical residual of the *Ph. Praecox* shoot production to the hazard-free production standard. In fact, the county government and forestry bureau also need co-

[34] The State Administration For Industry & Commerce of the People's Republic of China (SAFIC) based on the "Farmers' Professional Co-operatives Legal Document" in 2006 to appeal individual farmers to initiate the establishment of the co-operatives. Until now, there are more than ten thousands farmers' co-operatives in China.

operatives to increase the state's influence on individual farmers' practices through collaborating with farmers' co-operatives. Therefore, there is control and co-operation existing in this linkage between local county government and the farmers' co-operatives (see Figure 33).

Through forming partnerships with fertilisers' co-operatives, the Lin'an Bureau on the one hand can trace the origin of the fertilisers. On the other hand, collaborating with bamboo shoot co-operatives, the Lin'an forestry bureau can extend its indirect rule on farmers' fertiliser usage and cultivation procedures to achieve the hazard-free production standards. This standard is tried to control (1) the remains of chemical fertilisers in the bamboo shoot should be within safe standards; (2) the surrounding areas of the bamboo shoot forestland should monitor solid waste and stream pollutions, and (3) the production procedures, techniques application, processing, packaging, storage and transport should reach the standards. The co-operatives are operated by keeping good relationships with farmers through various niches of services such as soil testing and fertiliser matching, and increasing the market network of bamboo shoots. Informal governance structures such as trust, negotiation, and verbal agreements are common within the co-operative's networks. Farmers' co-operatives also signed *Ph. Praecox* bamboo shoot production contracts with individual farmers with protection prices, provided production trainings and workshops for contracted farmers to maintain the hazard-free production standards (see Figure 33). To further understand how farmers' co-operatives make trust and verbal agreements with the bamboo shoot farmers to achieve the hazard-free production standards, the Yi Wei Fertiliser and Kao Yuen Bamboo Shoot Co-operatives will be discussed in the following section.

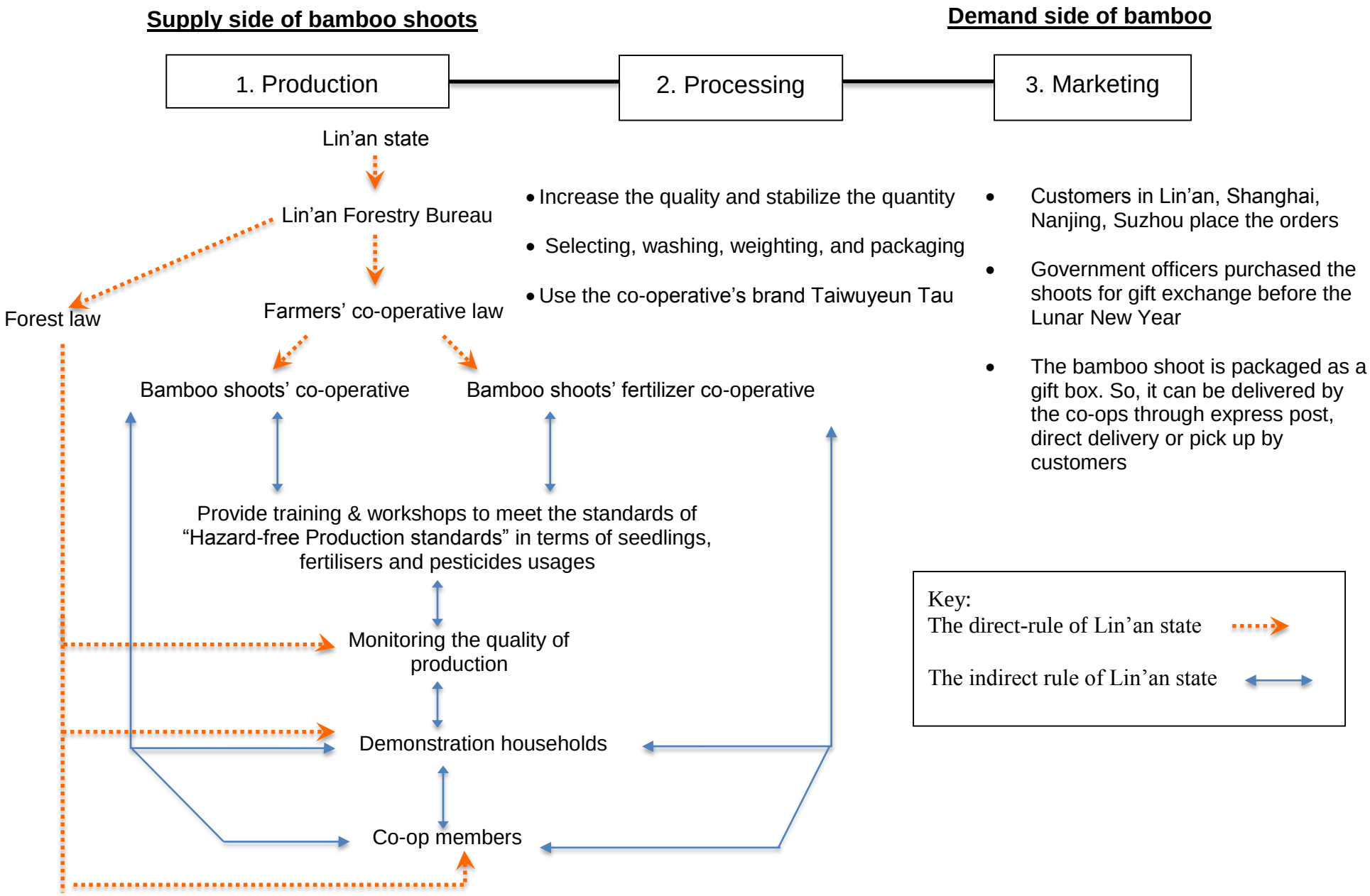

Figure 33 Bamboo Shoots and Fertiliser Co-operative's Network

6.4.1 Yi Wei Fertiliser Co-operative

This Yi Wei Fertiliser Co-operative was newly established in 2012 under the guidance of a private fertiliser wholesaling company called Yi Wei Biological Technology Company, which produces and processes fertilisers for bamboo shoots' producers. Members who buy the co-operative's fertilisers will obtain standardised quality fertilisers, and trainings. This co-operative has 100 members and the scale is small.

According to a director of the fertiliser co-operative, it provides three major functions: (1) soil testing and soil condition consultancy services (see Figure 34), (2) manufacturing and wholesaling of tailor-made non-toxic fertilisers (see Figure 34), and (3) facilitating the county Forestry's Bureau's technological extension services to promote fertiliser which meets the hazard-free production standards. The director Mr. Lin explains:

> Our co-operative received 5 years funding from the Lin'an Science and Technology Bureau to conduct research on the optimum composition of chemical and organic substances in fertiliser, which can restore degraded soil and meet the hazard-free production standard. And our research was successful because we collaborated with the Zhejiang Agricultural and Forestry University, Lin'an Forestry Bureau, and the Agricultural Bureau's soil testing station to learn from their techniques to test the soil and their knowledge to blend the appropriate proportion of chemical and organic substances (Interview with co-operative director C01, 2012).

Figure 34 Services Provided by the Yu Wei Fertiliser Co-operative
(Source: Author's Collection)

Apart from collaborating with the government and research institutions, there are four major ways for the Yu Wei Fertiliser's Co-operative to develop trust with farmers and influence them to adopt the co-operative's fertilisers. Each of these trust-making strategies is further discussed:

(1) Experience the effectiveness of the fertiliser

According to the fertiliser co-operative's director there are some weaknesses:

> Most farmers lack the market information to identify the quality of the fertilisers. Some fertilisers are counterfeit and even toxic. The source of the fertilisers is difficult to trace. However, if farmers purchased fertilisers from our co-operative, at least they could know where it came from….we will let farmers try our products and let them realize the improvement of their plantations. Once farmers see bamboo become greener and healthier, they will come back to buy the fertilisers (Interview with co-operative director Mr. Lin C01, 2012).

This is trust building based on actual effectiveness from the fertilisers applied on the bamboo plantation when farmers experienced the actual effectiveness of the fertilisers; they would have higher confidence to continue using the co-operative's fertilisers.

(2) Scientific validation and soil testing services to build trust

The co-operative provided soil testing services to tailor make fertilisers to meet farmers' soil conditions. A soil laboratory has been established in order to build trust and goodwill to attract potential members to buy fertilisers in the co-op. This is because the director has seen a service gap (niche market) in Lin'an County and as he explains.

> The Lin'an Agricultural Bureau [different from the Forestry Bureau] provided a soil testing service[35] to ameliorate the soil degradation in Lin'an after prolonged chemical fertiliser usages; however, there was a loophole for the soil testing service because the Bureau merely helped the farmers to test the soil without helping them to match the right fertilisers for their own plantations. Consequently, the Bureau just identified farmers' soil problems but did not solve them. Then, this created a service gap for the co-op to help farmers to identity the soil problem and to individually tailor fertiliser content (Interview with co-operative director Mr. Lin C01, 2012).

[35] The soil testing service is a national wide program which is funded by the central state to assist Chinese farmers to improve soil degradation after prolong chemical fertiliser usages.

Therefore, now a fertiliser co-operative provides soil testing and fertiliser matching services to the farmers in Lin'an County. The testing will include three major points of information: (1) sampling village identification and farmers' names, (2) testing organic substance content and pH value, and (3) identifying the sulphur, potassium, and phosphate contents. Based on the testing results, the co-operative staff tells farmers what type of the co-operative's fertilisers are best for their soils. This evidence-based testing increased the trust for farmers. However, there is no formal contract between farmers' households and the co-operatives. Instead, verbal agreements have become a norm which has been made such as the soil testing results and the amount of fertilisers that should be applied and are kept confidential between farmer households and the co-operative.

(3) Familiarity and frequent communication increase trust in local culture

Talking on mobile phones and face-to-face contacts are the ways of communication in the co-operative. Teas are served in order to create a rapport in the meeting environment for both customers and members. There are comfortable sitting areas for farmers to come and sit to chat about the techniques of fertilisers' usage, and identify demonstration households' schedules on fertiliser application. This is due to the timing of fertilisers' application being one of the decisive factors, which affects the shooting performance of bamboo. The co-operative also uses the sitting areas as places to promote its new products and new soil testing consultancy services. The staff in the co-operative use mobile phones to provide prompt consultancy services; the prices of the fertilisers, the retrieval of farmers' soil condition in their labs, and address key fertiliser application problems. In short, using mobile phones and treating the co-operative as a meeting place are crucial ways to build up trust for the co-operatives and the members.

(4) Recommendation by the forestry bureau technicians

The director of the fertiliser co-operative realise building close relationships with the Forestry Bureau would get higher endorsement in promoting his fertilisers for Lin'an farmers.

> I have to do lots of networking and demonstrating tasks by visiting farmers' plantations to provide direct guidance and involve myself in the Forestry Bureau's technological extension service. Whenever the Forestry Bureau's technicians visited the farmers, I would like to participate in their training courses. You know, I have been working in fertiliser manufacturing and networking with Lin'an forestry officials for more than five years. Now, I have earned the trust from the Forestry Bureau because my fertilisers increase farmers' productivity and ameliorate the toxicity of the soil. Therefore, I could accompany the forestry bureau's technicians to promote the co-op fertiliser and work with key government officials and forestry technicians to develop business opportunities and provide fertiliser promotion channels (Interview with co-operative director C01, 2012).

On the one hand, the fertiliser's co-operative needs the government's endorsement and recommendations to promote its products. On the other hand, the fertiliser co-operative also helps Lin'an state to address one policy gap. This policy gap was created because the Lin'an Agricultural Bureau merely provided soil-testing service[36] for bamboo shoot farmers and the Agricultural Bureau cannot help farmers to match the appropriate fertilisers. However, the fertiliser co-operative can fill this policy gap because the fertiliser co-operative provides both soil testing and fertiliser matching services. To further verify the effectiveness of the fertiliser, a crosschecking interview has been conducted with the fertiliser co-op's members.

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[36] According to the Ministry of Agriculture's Soil Testing Formulation Specifications (No. 2, 2006), there are six major procedures of soil testing and formula fertiliser specifications: (1) the use of jargons in soil testing and fertilisers formulation (GB/T 6274), (2) the dose rate and the proportion of nitrogen, phosphorus, potassium, and organic matters (NY/T 496), (3) the measurement procedures of the effectiveness of the fertiliser (NY/T 497), (4) the classification of arable land and its fertility's classification (NY/ T 309), (5) ways to conduct farmland survey and evaluate the capability of surveying techniques (NY/T 1634), and the regulations of soil monitoring procedures (NY/T 1119).

One co-operative member Mr. Liu commented:

> Until 2006, soil decay caused my bamboo plantation deterioration even young bamboo could not survive. Therefore, I asked this fertiliser co-operative for a solution and tried its fertilisers. Once I applied 340 kg of the biological and organic fertiliser from this co-operative, my bamboo plantation was rejuvenated! Even pests and diseases are ameliorated (Interview with bamboo shoot farmer F05, December, 2012).

From the above comment, this co-operative member did find the fertiliser useful and workable. Not only did he experience the regeneration of his plantations but also he increased his income after using the co-op's fertiliser. To a certain extent, the fertiliser co-operative can influence a small group of farmers to re-orient the unsustainable practice of using a plethora of chemical fertilisers to replacing them with more organic fertilisers to rejuvenate the decayed bamboo soil.

There are interconnections and complementary roles between fertiliser and bamboo shoot co-operatives because the fertiliser co-operative sells the fertilisers to the bamboo shoots' co-operative; meanwhile, the bamboo shoot co-operative can safeguard the origin and quality of the fertilisers to meet the hazard-free production standards. The next section uses the Kao Yuen Farmers' Bamboo Shoot Co-operative (Kao Yuen Co-operative in Short) as an example to examine how the Lin'an state uses the bamboo shoot co-operative to promote hazard-free production standards for its members and increase its indirect influence on farmers to follow the standards.

6.4.2 Kao Yuen bamboo shoot co-operative

In 2009 the Kao Yuen bamboo shoot co-operative was newly established by a private firm called Lin'an Modern Technology Centre; it is a medium-sized bamboo shoot co-operative which influences around 1,300 bamboo shoot

farmers across Lin'an County. Their members are dispersed over the whole county and influence 7,500 ha of bamboo land cultivations. The Kao Yuen co-operative possesses 225 ha of land. This co-operative is mainly buying bamboo shoots from 103 members. The co-operative helped its members sell 90% of their bamboo shoots before the Lunar New Year. The brand is called "TaiWuYuen Tau" named after its location at the head of the TaiWuYuen River. The brand reflects regional specialty, which give a sense of a locally produced product. The co-operative has guided its members to adopt the hazard-free production standards from seedling propagation, production processes and proportion of fertilisers being used.

The co-operative establishes two techniques to fulfil the hazard-free production standards: Pollution-free and Four Season Productive Propagation Technique (DB3301/ T180-2010), and *Ph. Praecox* Bamboo Shoots Soil Rehabilitation and Nutrients Supplement Technique (DB3301/T199-2011). These tailor-made production techniques are used to fulfil the provincial-wide Hazard-Free Bamboo Shoot Production Standards (DB33/333.3-2006). These two techniques focus on six major details: (1) propagate and cultivate bamboo shoots, (2) control of toxic pesticide usage, (3) control of pests and diseases, (4) proportion fertiliser usage, (5) test the chemical remains in the soil, and (6) provide soil testing and fertiliser matching procedures (Chen, 2009, pp. 16-21). There are three major ways to discuss the maintenance and the quality of the co-operative's bamboo shoots to achieve the hazard-free production standards.

First, the bamboo shoot co-operative collaborates with the Yu Wei fertiliser co-operative (aforementioned in section 4.1) to safeguard the proportion of chemical and organic substances in the fertiliser so that it reaches the hazard-free production standard. On the one hand, the bamboo shoot co-operative recommends members to use the approved fertilisers from the Yu Wei fertiliser co-operative. On the other hand, the fertiliser co-operative also provides free soil testing services for the Kao Yuen bamboo shoot co-operative's members.

According to the director Mr. Chen of the Kao Yuen bamboo shoot co-operative, there are written contracts used to maintain the hazard-free production standards with its members.

> Our bamboo shoots products have a brand name called "*Taiwuyuen tau*" and farmers sign a contract with the co-op because we have standardisation in production procedures, fertilisers and pesticide usages. Therefore, the size, weight, width, and quality of our bamboo shoot products are standardised (Interview with co-operative director C02, 2012).

Additionally, the Kao Yuen co-operative uses higher purchase prices to encourage farmers to reach their standards. In particular, the co-operative pay 1 to 2 Yuan above the market prices to purchase farmers' shoots. To understand how to set the bamboo shoots' selling prices for the Kao Yuen co-operative, the director Mr. Chen explains:

> We will refer to the market price and the co-operative purchases members' shoots with 1 to 2 Yuan per catty higher than the market prices. For instance, we purchased members' shoots 20 Yuan per catty[37] [1 catty is equivalent to 0.5 kg). After deducting the cost of labor and depreciation, the net purchasing prices is 10 Yuan higher per catty than the market value (Interview with co-operative director C02, 2012).

One method for the co-operative is to package shoots as a gift box. Each gift-box of shoots contains 25 to 30 shoots. The value-added process depends on the seasonality. The director of the Kao Yuen co-operative Mr. Chen commented, "if the gift-box shoots are sold before the lunar New Year when fresh vegetables are scanty, the marketing price is around 40 to 50 Yuan per catty. Therefore, when each package contains four to five catty, which means the selling price of the gift box shoots can be sold from 160 Yuan to 250 Yuan per box (Interview with co-operative director C02, 2012).

[37] Catty is a traditional Chinese unit of mass used in China for weighing bamboo shoots which is equivalent to 0.5 kilogram.

In addition, establishing linkage with demonstration households is another way for the bamboo shoot co-operative to diffuse the knowledge and practices of production standards and soil restoration techniques. The bamboo shoot co-operative would put a sign on demonstration reading "*Ph. Praecox* Shoot Plantation" to signify that plot of lands are using hazard-free production standards with the co-operative's guidance. Also on the sign, the name of the farmer, types and descriptions of soil restoration technology adopted will be indicated (see Figure 35).

Photo credit; the author, 2012

Figure 35 Signs Showing the Restoration Technique

Farmers who are interested in those soil restoration techniques and the ways to achieve hazard-free production standards can either contact the demonstration households or the co-operative to receive free consultation. According to the demonstration household of the co-operative Mr. Shao,

> More than 100 farmers consulted me for my cultivation techniques, farming schedules, and types of fertilisers which I am using. There are around 30 farmers closely tied with me. Whenever they have problems, they come to my house to have a chat with me" (Interview with demonstration household, 2012).

The co-op not only nurtured its own demonstration to display its hazard-free production standards but also employed the networks of the demonstration household to promote their brands and attract interested farmers to join the bamboo shoot co-operative. To consider the effectiveness of hazard-free production standards and soil restoration techniques to achieve sustainability in Lin'an production, the next section analyses the comments from the bamboo shoot co-operative's demonstration household and Lin'an Forestry Bureau Official.

6.4.3 Discussion of the role of technology and governing capacity to achieve sustainable development

According to a demonstration household, Mr Shao, who has been using early shooting technology for more than 14 years and continuously generated the highest *Ph. Praecox* shoot production within 17 mu (2.55 ha) of bamboo plantation in Lin'an County:

> Since 1994, I adopted the early shooting technology and until 2006 all of my *Ph. Praecox* shoot plantation was degraded because of prolonged use of chemical fertilisers. This worries me because of the problems of soil hardening, pests and diseases, and the difficulty to keep the mother stalk. Basically, all of *Ph. Praecox* bamboo plantation was degraded. Around 2007, I joined the Yu Wei and Kao Yuen co-operatives to consult their soil restoration techniques and hazard-free production standards to rejuvenate my degraded plantations. These techniques included reducing the density of the *Ph. Praecox* bamboo to increase photosynthesis in the plantation, using around 100 kg of the Yu Wei's co-operative fertilisers [more organic substances] and adding around 35,000-kilogram of a new soil layer to let the plantation be fallowed for three years. So, in 2010 my plantation was rejuvenated. After soil restoration, I reapplied the early shooting technology to cover 0.165 hectare (1.1 mu) and earned around 40,000 Yuan with total production of 770 kg (1540 jin) of *Ph. Praecox* bamboo shoots. However, the pest and disease problems such as bamboo fly [Aiolomorphus Rhopaloides Walker] are still serious so the chemical control of dichloro-diphenyl-trichloroethane (DDT) and omethoate emulsions are used (Interview with demonstration household D06, 2012).

From Mr. Shao's experience, to a certain extent he is able to re-orient unsustainable bamboo shoot practice under the co-operative's assistant by replacing chemical fertilisers and using soil restoration techniques to rejuvenate the soil. However, the pests and diseases are still prevalent in Mr. Shao's plantation even after he adopted those technological fixes; his strategies to solve the pest problem is to adopt those toxic and potentially hazardous pesticides because he feels he has no alternative if he is to maintain his household income. Furthermore, the demonstration household of Mr. Bian from the Kao Yuen bamboo shoot co-operative commented,

> Different bamboo shoot farmers have different schedules to use their pesticides, even though I killed those pests in my plantation, the pests from adjacent bamboo plantation will easily fly over to my plantation. This triggers me to apply a pesticide again and this will increase the insecticide resistances of those pests.

The design of the Forestland Responsibility System was to distribute forestland fairly for every farmer; however, it causes low productivity and inefficiency because of small landholdings and land fragmentation. From Mr. Bian's comment, the pests and disease problem is related to land fragmentation and smallholding because when farmers want to get rich, they have to apply the early shooting technology in their small plot of land. Even though farmers adopt soil restoration techniques and comply with hazard free production standards, land fragmentation hinders farmers from having a unified pest control system which may well limit the effectiveness of the individual management of pests and diseases.

Both Mr. Shao's and Mr. Bian 's comments raises concerns about the potential of striking a balance between the high productivity of bamboo shoots and using more organic fertilisers and cleaner soil to ameliorate the pest and disease problem. Although the farming practices of the demonstration household has changed as organic fertilisers replace chemical fertilisers ones; the mentality of aiming for high output from a small plot of bamboo forestland is unchanged.

Besides that, although the Lin'an County government identified the soil degradation problem in the early 2000s, there was only sluggish progress to improve the situation. According to one forestry official Mr. He who has been involved in the County bamboo shoot production programme more than 30 years:

> Although we identified the soil degradation problem since the 2000s, we received small portion of funding from central and provincial government to tackle the soil degradation problem. More astonishing is that, a large portion of the funding was missing from this top-down bureaucratic channel. Please don't ask me where did it go? I didn't know either… (Interview with Lin'an Forestry Bureau official G02, 2012)

From the above statement, the informality or the deficits in policy implementation affect the capability of the Lin'an state and forestry bureau officials to ameliorate the soil degradation problem at a countywide scale. In fact, the bamboo shoot production system in Lin'an is full of dynamics and complexities.

From an ecological modernisation perspective, the Lin'an state did not see environmental degradation as a limiting factor for economic growth but rather identified technology and increasing governing capacity (e.g. hazard-free production standard) to fix this problem. For instance, the institutionalisation of cleaner bamboo shoot cultivation practices such as controlling the types and dosages of fertiliser and pesticides' usages in order to restore ecological vitality and reduce soil degradation, even if these innovations were not wholly successful. The partnerships among Lin'an state, farmers' co-operatives, research institutions, and demonstration households enforce the direct and indirect rules of the local state to control the quality and food safety of bamboo shoot cultivation. For example, to a certain extent the collaboration among the Lin'an forestry bureau, bamboo shoot and fertiliser co-operatives can help bamboo shoot farmers to re-orient part of the unsustainable practices of bamboo shoot cultivation by replacing chemical fertilisers with more organic ones.

From an eco-Marxist perspective, the local state remakes bamboo shoot production systems from backyard gardening (use value) to intensive production (exchange value) through the promotion of early shooting technology. Although the local state uses the bamboo shoot co-operatives to institutionalise standards, the network is confined to a small section of the bamboo shoot production system (e.g. the co-operative network and demonstration households' social networks) which affected a limited range of bamboo shoot farmers. The impact of using co-operative networks takes time to diffuse and influence other farmers to adopt the hazard-free production standards. From the eco-Marxists' perspective, there would be a sceptical attitude toward the effectiveness of using hazard-free production standards and soil restoration techniques to narrow the gap between the exchange value of early shooting technology and the use value of bamboo for mountain conservation. This is because a pro-growth mentality still dominates the mode of production in Lin'an and even the rejuvenation of bamboo forestlands still acts like a growth machine to generate more bamboo shoot resources. Relentless growth with insufficient attention to system constraints, particularly small landholding and land fragmentation leads to the deterioration of the whole bamboo shoot production system by making the use of pesticides to control the pests, which in turn increases the threat of water pollution.

Since the soil life was over utilised under the early shooting technology, political ecologists would on the one hand be concerned about the risk of soil erosion and the vulnerability of the bamboo shoot production system. This will be shown in the productivity of bamboo forestland, and affect both the short and long terms interests of producers (Blaikie and Brookfield, 1987; Bryant and Bailey, 1997). On the other hand, political ecologists see the technological potential of soil restoration techniques; however, they would be worried about land fragmentation limiting the effectiveness of implementing hazard-free production standards and eliminating pests and disease.

6.5 Conclusion

This chapter provides a bottom-up dimension to understand how the Lin'an state collaborates with research institutions, farmers' co-operatives, and demonstration households to influence farmers to adopt hazard-free production standards and soil cleaning technology to achieve the sustainability in the bamboo shoot production industry. From the empirical assessment, to a small extent the local state can extend it authority to influence farmers' behaviours to adopt the hazard free production standard and soil restoration techniques through the co-operative and demonstration households' networks. However, to a large extent there are still large groups of bamboo shoot farmers which may not be able to receive proper trainings to restore their soil and comply with the production standards. Furthermore, the informality and implementation deficit of the government policy has caused the countywide soil restoration programme to be sluggish and it produces stumbling block for a countywide modernisation of the bamboo shoot production and re-orientation of farmers' unsustainable practices. Although farmers' co-operatives, demonstration households and research institutions extend the arm of state in multi-nuclei forms to control the standards of the bamboo shoot production, the changes of bamboo shoot practices does not means that the local state and bamboo shoot farmers prioritised environmental rationality before economic development. In the next chapter, we will explore more in-depth how local state, processors and market traders further tape local resources and social capital of Lin'an farmers to achieve economic growth.

CHAPTER SEVEN: THE GOVERNANCE OF INDUSTRY INTEGRATION

7.1 Introduction

The preceding chapter examines how the local state and non-state actors interact in a horizontal axis of governance to strike a balance between the profitability of using the early shooting technology and the promotion of “hazard-free production standard” (cleaner way of production) to achieve sustainability. Since the mid-1990s, the Lin’an state put forward a bamboo resource-based model of development, conflating the concept of “sustainable development”, which it envisioned as economic development in perpetuity with bamboo shoot production, unhindered by the environmental limits of the ecosystem. This model of sustainability stresses on pro-growth mentality and material needs of local people by increasing the capacity of bamboo shoot cultivation. This chapter further examines how the local state collaborates with bamboo shoot processors and market traders to further exploit the bamboo shoot resources, labour and social capital of Lin’an farmers to widen this resource-based development model. To reflect on the sustainability how the Lin’an state integrates the production, processing and marketing sectors to (1) rationalise and re-collectivise the fragmented land resources through land transfer and (2) use the bamboo shoot processing industry and market development to absorb the over-produced shoots from producers to create economic value.

To answer these two questions, this chapter is divided into five sections: Following the introduction, section two addresses how the Lin’an state recollectivise land resources to increase its guidance on individual farmers to restore soil and implement hazard-free production standard in a regional scale. Section three elucidates how the Lin’an state collaborates with the Bamboo

Shoot Processing Association to institutionalise the processing standards, and implement quality assurance system to regulate the bamboo shoot processors to comply with the international standards and increase influences on producers' practices. Section four examines how fresh bamboo shoot market prices are negotiated and graded among farmers, small intermediaries, large middlemen in Lin'an bamboo shoot market and wholesaling market in Shanghai. Finally, an evaluation of the effectiveness of industry integration, institutionalisation of production and processing standards, and the state to influence the market prices in the Lin'an bamboo shoot production industry.

7.2 Debates on the role of the state and technological fixes

To contextualise the bottom-up implementation of sustainable development policies in Lin'an County, this chapter harness the perspectives of ecological modernisation, eco-Marxism and political ecology to examine the role and steering approach of local state to co-ordinate bamboo shoot processors, demonstration households, market traders and bamboo shoot farmers to manage land re-organisation, institutionalise processing standards and bamboo shoot market

In analysis of land re-organisation, institutionalisation of processing standards and role of market from ecological modernisation perspective, ecological modernists concern how the Lin'an state co-operates with demonstration households, bamboo shoot processors and market traders to rationalise bamboo shoot resource management (Economy 2006; Ho 2006). Particularly, addressing how the Lin'an state rationalise land organisation and establishes bamboo shoot processing standard to improve the quality of bamboo shoot processing. Through the institutionalisation of processing standards and utilise human capital include labour, artisan skills and culture of local farmers are

capable to mitigate environmental degradation and economic development in Lin'an development model. In so doing, the approach of ecological modernists is to consider the effectiveness of the partnerships with non-state actors to mitigate the negative environmental impacts of bamboo shoot production in Lin'an County (Bai et al*.,* 2007; Boström and Klintman, 2006, p. 165). Additionally, ecological modernists help this research to question whether increasing marketing channels can help Lin'an County to increase governing capacity to allocate and prioritise bamboo shoot resources (Mol et al., 2009) For example, understanding how the Lin'an state collaborate with producers, processors, and market traders to manage large pool of bamboo shoot resources to increase economic values, product differentiation and market segmentations of bamboo shoot resources.

However, eco-Marxists are doubtful about the effectiveness of land re-organisation and partnerships among local state, processors and market traders to ameliorate the environmental degradation problems in Lin'an County. First, the land re-organisation is to break the bottleneck of production by re-collectivising land resources for better bamboo shoot management. Therefore, re-collectivisation of land may not able for the Lin'an state to tackle the fundamental problem of heavy extraction of bamboo resources because unfettered capitalist growth exacerbated resource exploitation (O' Connor, 1998). Second, eco-Marxists question about the capability of bamboo shoot processing industry and market to distribute economic benefits equally in the bamboo shoot supply-chain (Harvey, 1996). Rather, the partnership among local state, bamboo shoot processors and market traders is to further tapping bamboo shoot resources and social capital of Lin'an farmers to perpetuate the value-added conditions in the supply chain.

Political ecologists also question whether the partnerships among local state and processors and market traders become a governing tool to extend the arm of state to extract more bamboo shoot resources and tap more social capital of Lin'an farmers result in uneven distribution of economic benefits and

environmental harms (Ferguson 1990; Tilt, 2010; Blaikie and Muldavin 2004; Yeh, 2009). For instance, bamboo shoot farmers posit in a marginalised economic position when their bamboo shoot plantations are degraded; their marginalisation mirrored by low bargaining power in price negotiation. More importantly, political ecologists help this research to contextualise how both state and non-state actors' environmental values are grounded in this resource-based production model and how their values are shaped by pro-growth mentality (Tilt, 2010, p.106; Weller, 2006, p.141). For instance, evaluate how state and non-state actors understand the meaning of sustainable development in the bamboo shoot production system.

Situating the above debates on the land re-organisation, institutionalisation of processing standards and role of market among ecological modernists, eco-Marxists and political ecologists; this research is going to examine the effectiveness of the local state to recollectivise land resources, institutionalise processing standards and develop bamboo shoot market to utilise bamboo shoot resource to sustain economic growth and mitigate environmental degradation.

7.2.1 Re-collectivising fragmented and small landholdings

Since the 1990s, the promotion of the early shooting technology in Lin'an County has generated a perverse policy response, which has produced a treadmill of boosting bamboo shoots' productivity and overusing fertilisers, and resulting in the degradation of bamboo forestlands. The awareness of bamboo shoot farmers on soil degradation was grounded in a sense that their livelihoods were being threatened. Bamboo shoot farmer Mr. Xie commented,

> Soil degradation hurts my income badly. There are no ways to regenerate soil fertility because after prolonged intensive cultivation [early shooting

> technology application] has taken place for three to four years. All the fertility was absorbed by previous harvested bamboo shoots, there is no way to get back to original outlook even putting peanuts husks on the soil is not successful. This is because the roots of the bamboo were hurt by acidic soil. I don't know what to do next? (Interview with bamboo shoot farmer F14, 2012)

From Mr. Xie's comment, forestland is bamboo shoot farmers' lifeblood to earn their daily breads. Tilt (2007, p.91) argues that land vitality is crucial for farmers because it is "the source of day-to-day sustenance, it also constitutes the only real social security most farmers will ever know." The soil degradation is exacerbated in Lin'an when farmers tried to increase the intensity and productivity of *Ph. Praecox* shoot production with applying plenty of chemical fertilisers and covering materials, which increase soil acidity and pollution, and crop failure in result. In fact, crop failure can bring economic risk for bamboo shoot farmers and Lin'an Forestry Bureau technician Mr He explains,

> Basically, the soil degradation has produced economic risks for bamboo shoot farmers because it affected their profit margins. This affects farmers' incentives to grow bamboo shoots. From my observation, the soil degradation has produced four types of farmers. They are: pro-active farmers, part-time farmers, abandoned farmers and subcontract farmers. Each type of farmers represents different motivation and responses toward soil degradation (Interview with forestry technician G02, 2012).

From the forestry official Mr He's comment, we can see that different farmers have different perceptions and responses toward the risk of soil degradation. Beck (1992, p.26) argues that same environmental risk "can have quite different meanings for different people, according to age, gender, eating habits, type of work, information, and education and so on". In fact, soil degradation not only generated economic risks but also directly influence farmers' farming choices and motivation to grow *Ph. Praecox* bamboo shoot. According to forest official Mr. He's comments, these four types of farmers have different motivation to grow *Ph. Praecox* shoot (see Table 16).

Table 16 Soil Degradation, Farmers' Choices and Motivation

Types of farmer	Motivation to grow *Ph. Praecox* shoot	Responses to soil degradation
Type A Pro-active farmers	High motivation to grow plenty of *Ph. Praecox* shoots and contracted others farmers' lands though their plantations are degraded. This type of farmer works full-time in their plantation	Eager to adopt hazard-free production standards and soil restoration techniques to rejuvenate soil fertility
Type B Part-time farmers	When the *Ph. Praecox* shoot plantation was degraded, farmers are half-hearted to grow bamboo shoot because of decreasing economic benefit from bamboo shoot production. Then they worked as a part-time workers in urban areas	Minimum effort by applying organic fertilisers and manage the plantation after his/her works in the urban area
Type C Farmers who abandon their land	When the *Ph. Praecox* shoot plantation was degraded, farmers have a full-time job. Even though the land was abandoned, he doesn't contract to other farmers because land is regarded as their safety nets	Farmers gave up their plantation without doing anything and let the plantation regrow by itself
Type D Farmers who contract their lands to others	Farmers have full-time jobs in the urban areas; they didn't have motivation to grow bamboo shoots. Then he/she contracts or sells their land to other farmers	Farmers gave up their plantations by contracting out to pro-active farmers to rejuvenate it

Source: Interview with forestry official G02, 2012

Facing the problems of soil degradation and reduction of farmers' motivation on growing *Ph. Praecox* bamboo shoot, in 2003 the Lin'an state puts forward the Forestland Use Transfer Mechanism (FUTM) to encourage demonstration households, farmers' co-operative, agricultural firms, and bamboo shoot processing industries to contract farmers' abandoned lands to increase the scale of bamboo shoot production through land exchange, shareholding, establishing joint ventures with other farmers and private enterprises. Land

transfer is a policy mean for the Lin'an state to re-collectivise fragmented and small-holding forestlands into a larger segments of *Ph. Praecox* bamboo shoot plantation to (1) implement soil restoration technique and (2) apply hazard-free production standard in a larger scale. Particularly, the Lin'an state encourages rural committees to help demonstration households in their villages to contract other farmers' abandoned lands. When the segment of *Ph. Praecox* bamboo shoot continuously grows more than 15 hectares by joining demonstration households' land together, the Lin'an state and Forestry Bureau will designates that villages as a *Ph. Praecox* Shoot "specialised village" (see Figure 36). When joining those specialised *Ph. Praecox* shoot growing villages, which manifest into a region, the Lin'an state designates these villages as a "specialised region" (Jin and He, 2007, pp. 3-4). The rationale for the Lin'an state to re-collectivise the land resources is to rejuvenate degraded soil effectively and influence more farmers to adopt the hazard-free production standards (see Figure 36). According to Brown et al. (2008, p. 136), specialisation of bamboo shoot activities allows farmers to "generate higher income either through cost economies, higher technical efficiencies, the ability to product products suited to premium markets or the more efficient utilisation of inputs and production systems."

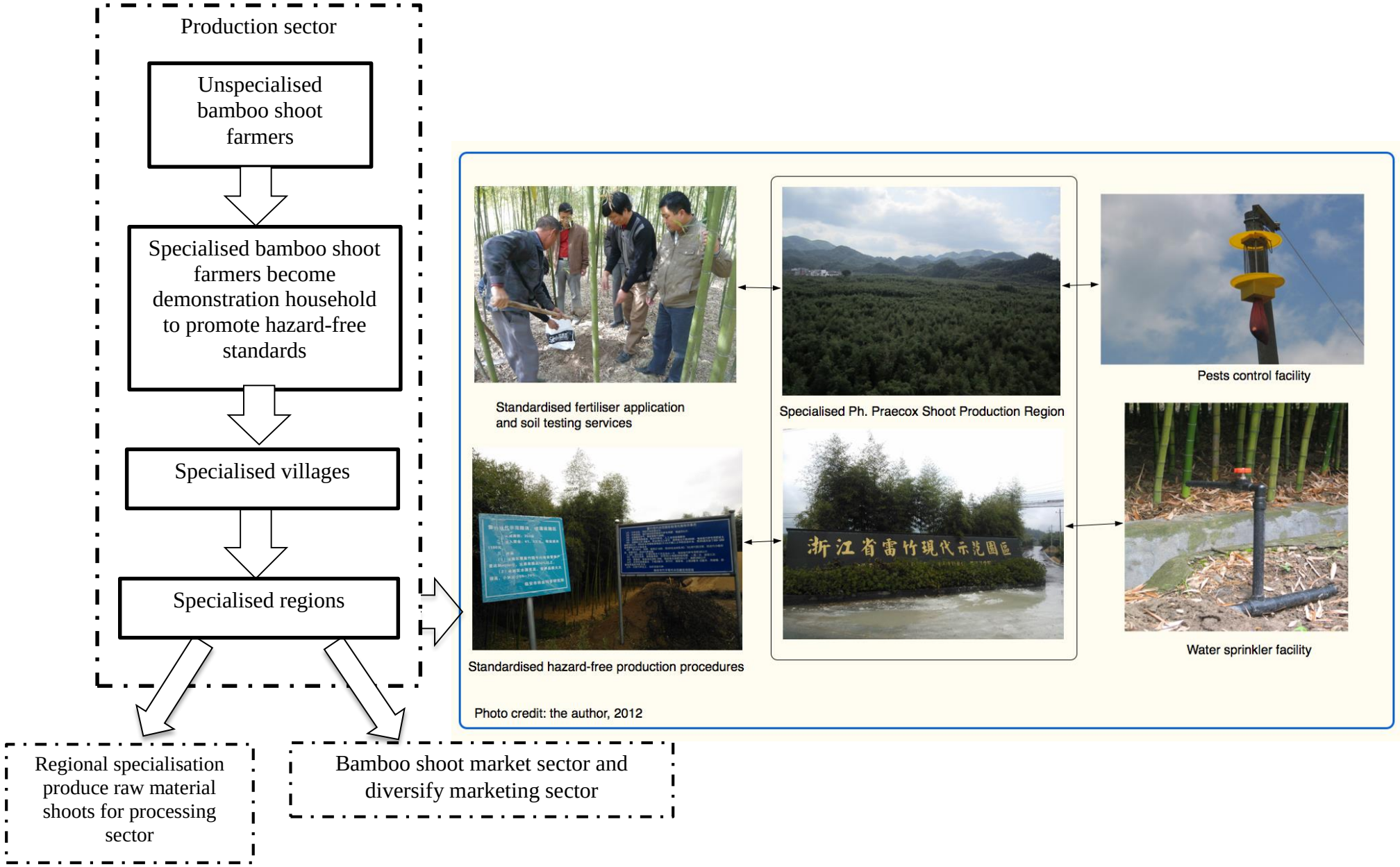

Figure 36 Regional Specialisation of Bamboo Shoot Production

7.2.2 Challenges of re-collectivisation of forestland resources

Although the Lin'an Forestry Bureau was successful to establish a 375 hectares of core *Ph. Praecox* shoot specialise region (see Figure 36) and carry out standardised soil restoration techniques (Lin'an Forestry Bureau, 2008), environmental challenges remained for the Lin'an state to re-collectivise the land resources through land transfer processes. Particularly, bamboo shoot farmers pay attention on land security and they reluctant to contract their forestlands to other farmers. According to the demonstration household Mr. Zheng comments,

> Farmers' mind-set is difficult to interpret! Everyone is working for money; some farmers work in the urban areas but they still own their forestlands. Why? On the one hand, they do not want to see other farmers to get rich from their bamboo shoot plantation because of jealous and peer comparison. On the other hand, the bamboo shoot plantation provides a safety net if farmers get unemployed; they still get something to generate from the soil. With a piece of land, I am not worrying about my retirement either because growing bamboo shoot can provide basic living expense for me (Interview with demonstration household D04, 2012).

From Mr. Zheng comment, bamboo shoot farmers would like to keep their lands because forestland is their lifeblood and safety net. Although farmers suffered from soil degradation, they may not contract their land to other farmers or leave their land abandon. Another demonstration household Mr. Jiang also comments that,

> There are lots of bamboo shoot farmers in my village work as part-time workers in the urban areas from August to October; mostly their bamboo shoot plantations are lack of management. However, they do not want to give up their economic interests [from their plantations] derived from early shooting *Ph. Praecox* shoots. So, they would like to keep their lands with lax management (Interview with demonstration household D11, 2012).

From Mr. Jiang's comment, he highlights the tensions between economic consideration and opportunity cost to contract their lands may lose their

advantages. From the above demonstration households' comments, farmers' divided and protective mind-sets hinder the state-driven land re-collectivisation process to tackle fragmented land resources and strengthen spatial management of bamboo shoot resource.

7.3 The bamboo shoot processing industry

The Lin'an state understands the regional specialisation of *Ph. Praecox* bamboo shoot production as an effective resource management strategy to increase the integration of the bamboo shoot production industry to achieve two major governing objectives: (1) use processing and marketing sectors to absorb the overproduced shoots from production sectors (Jin and He, 2007, p.6); and (2) increase the value-creation in the bamboo shoot supply chain by integrating the production, processing, and marketing sectors and institutionalising production and processing standards in the bamboo shoot production industry (He et al., 2002). The vertical integration among the bamboo shoot production sector and processing facilities, and marketing segments is highly dependent on two major policy directives as one forestry official Mr. Tang explained,

> Around 1995, we suggested the directive to "facilitate primary production, promote the logistics of bamboo shoots, and emphasise the development of the processing industry (前促生产，后活流通，主攻中间) In the 2000s, our bamboo policies focused on market development by proposing, developing production bases (shoots for dried bamboo shoots processing) in the mountain, building up bamboo processing industries underneath the mountain, and creating potential markets outside the mountain (山上建基地，山下建工厂，山外建市场) to increase the marketing channels of bamboo shoot products (Interview with Forestry Bureau official, G04 2012).

By analysing the causations of these major shifts in the bamboo policies, there is a trajectory of development for the industry from restructuring the production side (the 1980s - early 1990s) to integrating with the processing industry (supply side) to propelling the production side (from mid-1995 to early

2000s), and latter using market initiatives (demand side) to facilitate lengthening and adding value to the bamboo shoot value chains through opening up markets within and outside Lin'an county.

To increase the integration of the bamboo shoot production industry in Lin'an, the local state in 1998 established the Lin'an Bamboo Shoot Processing Association (LBSPA). The association became part of the Lin'an Forestry Bureau governing system to co-ordinate the industry integration and facilitate primary production and institutionalise the processing standards in the processing industry (Lin'an rural economy committee No. 97, 1997, p. 1). The LBSPA attracted foreign direct investment from Taiwan, Japan and Hong Kong to establish bamboo shoot processing firms in Lin'an County. Until 2009, the total production value of the whole bamboo shoot industry was 22.55 million Yuan and there are more than 66 bamboo shoot processing enterprises in Lin'an County which generate production values around 8.36 million Yuan (Lin'an Forestry Bureau, 2009). When comparing the production and marketing sectors in the bamboo shoot production industry, the bamboo shoot processing industry generated the highest production values (see Figure 37).

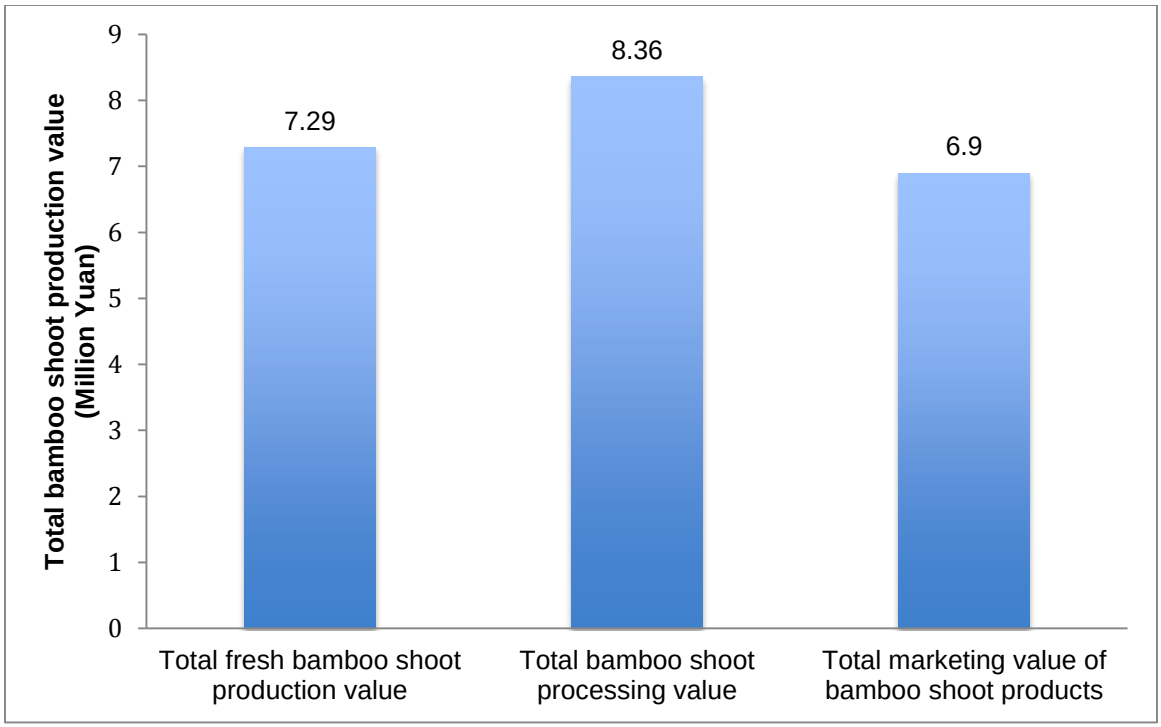

Figure 37 Total Production Value of the Bamboo Shoot production in 2009 (Source: Lin'an Forestry Bureau Forestry Statistics Database, 2012)

The Lin'an state not only uses the processing industry to provide job opportunities for the rural population but also creates a huge economic value. In fact, both the local state and processing firms are tapping bamboo shoot resources, artisan skills and knowledge of local bamboo shoot farmers to propel economic development and achieve a "relatively wealthy society." Bamboo shoot production is a place-based forestry practice with unique mountain climate and landscapes. The place-based specialties produce a geographical advantage, regional identity, and product specification. The mountain range in Lin'an County produce the imaginations of a mountainous climate which nurtured bamboo shoot with clean air and fresh water and skilful artisan techniques of Lin'an farmers in bamboo shoot production and processing gave people a sense that farmers in Lin'an have a deep socio-historical understanding of bamboo shoots. These imaginations and specific socio-cultural contexts constructed a sense of

freshness, traditional, and place for Lin'an bamboo shoot products (Ilbery and Kneafsey, 2000, pp. 217-218).

To further utilise the bamboo shoot resources to increase the economic values, the Lin'an state and Forestry Bureau extend their direct rule in the processing industry by guiding the LBSPA's development direction and strategies. For instance, the honorary chairman and chairperson of the association were the county mayor and the Lin'an Forestry Bureau head respectively (LBSPA, 1998, P.1). The LBSPA became the first "industry mediator" to manage the industry structure, promote forestry bureau policies, implement production standard and quality assurance system, provide funding for research and development on bamboo shoot production, and coordinate "stiff competition and price cutting" among processors and protect "the interests of producers" (Lin'an state office document No. 21, 1998, pp. 1-2). There are three rule levels of experts to steer the financial and human resources to increase the vertical integration between production sectors and the processing industry, upgrade the production standards, and diversify bamboo shoot products to create competitiveness. The rule of LBSPA is a top down organization in which the Committee at its regular meetings made all the decisions and three working groups were established to take actions (see Figure 38).

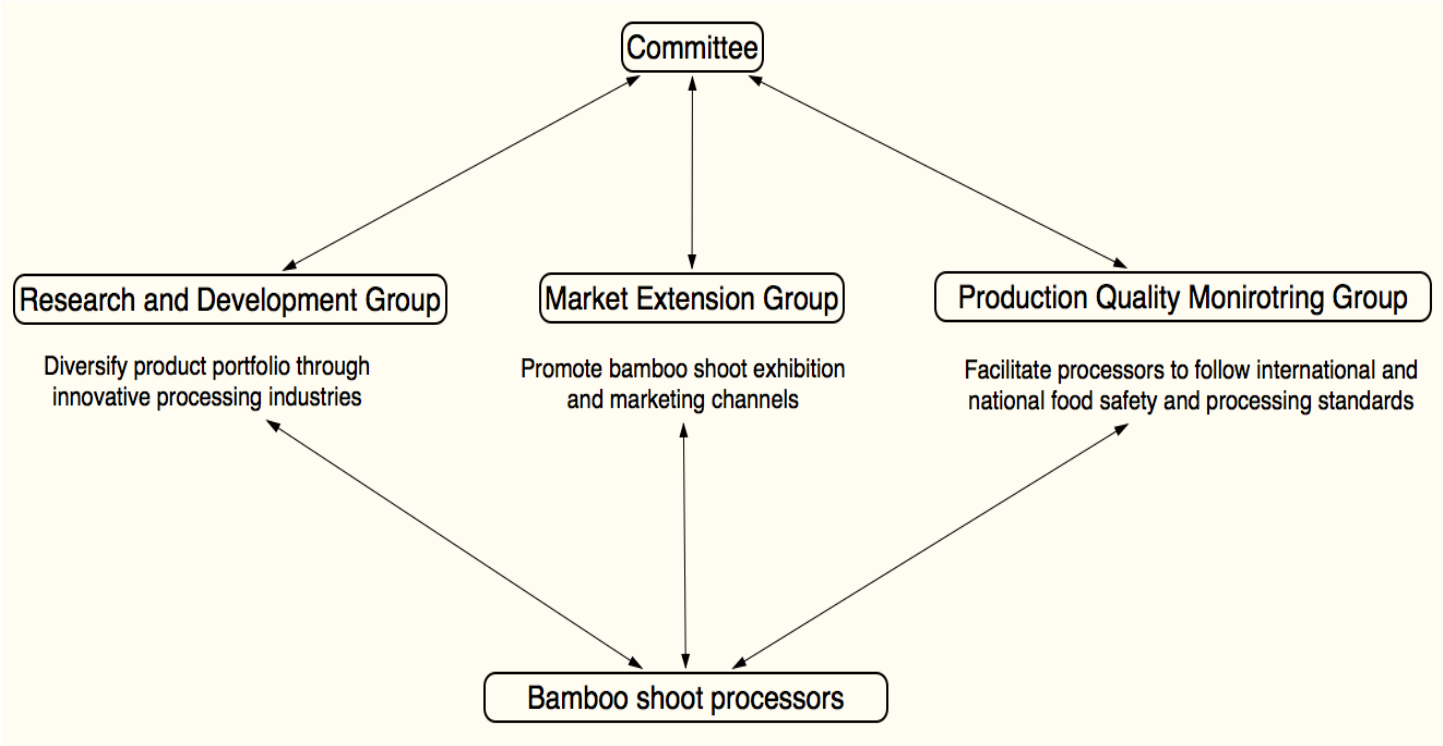

Figure 38 Organisation Chart of the Committee with the LBSPA
(Source: LBSPA, 1998, P.1)

The research and development group in the LBSPA collaborated with the Technological and Science Bureau (TSB) and Zhejiang Agricultural and Forestry University (ZAFU) to help bamboo shoot processors in Lin'an to develop innovative products include small packaging, seasoning shoots and "ready-to-eat" peeling off shoots (see Figure 39). From the 1980s to 2000s, technological innovations did help Lin'an processing industry to utilise bamboo shoot resources to diversity different products (see Figure 39). According to the LBSPA's research and development report (2005), there are two major reasons to boost the innovation in the processing industry: (1) to convert overproduced bamboo shoots into innovative products; (2) to increase the value creation in the supply chain. Additionally, the research group also helped processors to protect their technological innovation through patent, trademark, and copyright registration. All these made research and development group plays a crucial role to help the

bamboo shoot processing industry to optimise processing, utilise bamboo shoot resources and increase the processing industry's competitiveness.

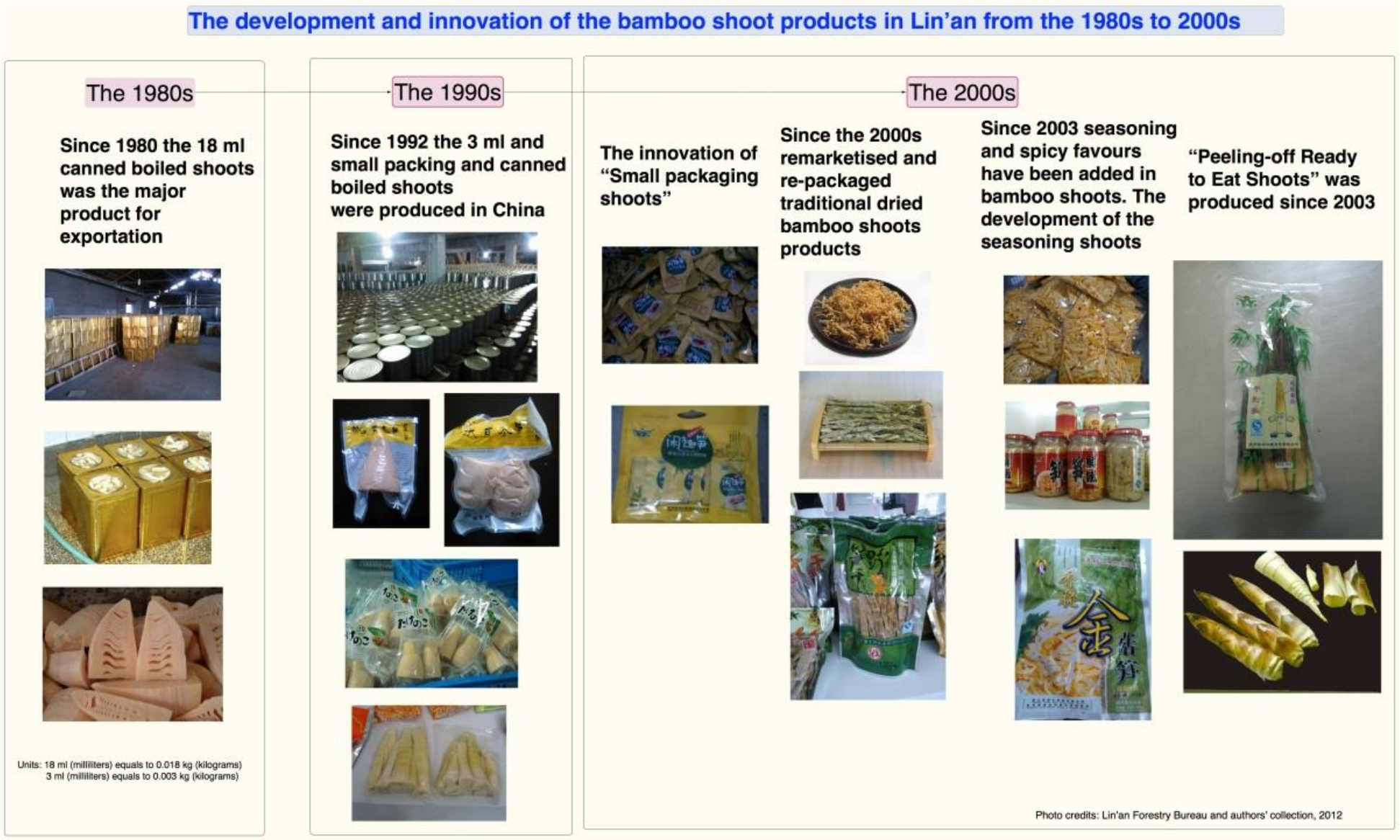

Figure 39 Product Innovation and Development in the Lin'an Processing Industry

To increase the fresh bamboo shoots' and processed bamboo products' marketing channel, the Market Extension Group in the LBSPA collaborated with the Lin'an Tourism board and county government to organise "Bamboo Shoot Festival", bamboo shoot products exhibitions in YiWu International Trade Market, and marketing promotion activities in Beijing, Shanghai and Wuxi (see Figure 40).

The Ph. Praecox bamboo shoot promotion activity in one of the Carrefour Supermarkets in the City of Wuxi in 2005

The Deputy Mayor of Lin'an promoted the Ph. Praecox shoots in the city of Wuxi in 2005

Credit: The Lin'an Forestry Bureau, 2012

Figure 40 State-Led Marketing Promotion Activities

The major function of the Market Extension Group was to facilitate processing industry to utilise the overproducing fresh bamboo shoots. From the official account, in 2011 there were around 41,030 tons of fresh Praecox that could not be processed by the processing industry and was be sold in the fresh shoot market so weakening prices for farmers (Lin'an Forestry Bureau Forestry Statistics Database, 2012). These reflected three major problems: first, the Lin'an state has promoted the early-shooting technology and caused the unfettered growth of *Ph. Praecox* shoots cultivation. As a result, oversupplying of *Ph. Praecox* shoots caused a very low market price and even produced an unpredictable profit margin for bamboo shoot farmers. Second, there is asymmetrical distribution of benefits in the bamboo shoot supply chain. Although there was a price floor (0.5 Yuan per kilogram) that has been set by the bamboo shoot processing association to protect bamboo farmers' interests, the price is

very low when compared to the value earned by the processors (see Table 17). Third, since there is not much profit margin for bamboo shoot farmers to earn from natural shooting *Ph. Praecox* shoots, farmers will further depend on the early shooting technology to obtain their benefits which further accelerates the soil degradation problem.

Table 17 The Production Cost and Profit of XiMaHe Food Company

Production cost	**Items**	**Values**
	Total quantity of fresh shoot purchased from farmers	50, 00, 000 catty
	Purchased price for farmers	0.5 Yuan
	Annual Labour cost (60 labour x 1400 Yuen x 12 months)	1008000 Yuan
	Industrial and production tax	2 million
Subtotal		5,508, 000 Yuan
Profit	Total boxes of processed bamboo shoot products	1, 650,000 boxes
	54 Yuen per box and each box weight 5.12 catty (Each box contains 20 packages of 128 grams of bamboo shoot)	89.1 million Yuan
Gross profits (not include electricity, salt and water cost)		83. 59 million Yuan

Source: Interview with the processor Mrs. Yu P02, 2012

In fact, the overproduced *Ph. Praecox* shoot problem is still prevailing and the processing industry cannot effectively to absorb those overproduced *Ph. Praecox* shoots. A Lin'an forestry bureau official Mr. He commented:

> In 2000, there was a township government official reported to our Bureau that bamboo shoot farmers dumped their shoots into the township government building to launch a petition on expressing their difficulty in selling fresh *Ph. Praecox* shoots (农民卖笋难的矛盾) and to tell the official to help them sell their shoots. To solve this problem, the Lin'an state directed the township levels of government officials to help farmers to sell their shoots" (Interview with Lin'an Forestry Bureau Official G02, 2012).

From the official's comment, the Lin'an state noticed that merely depending on processing industries to solve the overproduction of *Ph. Praecox* shoots is not enough. Instead, the Lin'an state tried to increase the processing quality of the bamboo shoots through institutionalising processing standards and further develop the marketing sectors of the fresh *Ph. Praecox* shoots to address the over-production problem. The former is to achieve by increasing the quality of bamboo shoot products in order to increase Lin'an processors' competitiveness and attract more consumers to buy their quality products. The latter is to work out through developing different marketing channels.

Particularly, China become a member of the World Trade Organisation (WTO) in 2001, the demands of the international market has driven the LBSPA and Forestry Bureau to institutionalise and monitor the processing standards of bamboo shoot products to comply with international standards. In Lin'an, the Product Quality Monitoring Group in the LBSPA monitor two major level of processing standards: (1) international standard for local-led processors to fulfil overseas market requirements, and (2) China's standard for local-led processors and small local processors (see Table 18).

Table 18 Two Major Levels of Production Standards

Standards	Market segments	Institutional setting	Segments of bamboo shoot product	Bamboo shoot products production standards
International standard for overseas market	Local-led processors	Export-oriented Bamboo shoot products are exported to Japan, US and Europe	Boiled bamboo shoots	Large amount of production with HACCP certificates, ISO9001, CAC, JAS Certificate
China's standard for internal market	Local-led processors	Internal market Large-scale of production	Boiled, dried, preserved and seasoned shoots	Bamboo shoot products comply with HACCP certificates, ISO9001 Certificate
	Small local processors	Internal market Small scale of production	Boiled, dried, preserved and seasoned shoots	Bamboo shoot production mainly comply with AQSIQ system

7.3.1 International standard for local-led processors

For local-led bamboo shoot processors who target selling their bamboo shoot products for overseas markets, they have to be in compliance with the international food safety law. To adhere international standards, processors have to follow four major international food assurance systems such as Codex Alimentarius Commission (CAC) food standard, Japanese Agricultural Standard (JAS), Hazard Analysis Critical Control Point (HACCP) and International Standard Organization (ISO) systems, particularly ISO 9001. In Lin'an, there are over 10 bamboo shoot processing firms that has obtained HACCP certificate and

ISO9001 certificate respectively (Lin'an Forestry Bureau – China's bamboo village report, 2006).

From the market segments, the JAS, ISO[38], HACCP and CAC standards are crucial for the export-oriented processors to follow (see Table 18). The HACCP[39] is a systematic preventative approach to regulate and control chemical usages, biological and physical hazards in fresh bamboo shoots' production and processing (Asia Green Agriculture Corporation, 2010, p. 14). The JAS system is an on-going quality control, monitoring and administrative inspection on the management structure, standards requirements, labelling, and sanitation of imported agricultural products on certified bamboo shoot processors (JETRO, 2011). The JAS standards require bamboo shoot processors to be in compliance with production standards, processing procedures, import clearance, inspection certificate, containers and packaging (JETRO, 2011, pp.3-11). There are both Japanese and overseas accreditors to certify the JAS certificates for bamboo shoot processors (JETRO, 2011, p.10; MAFF, 2014). To help local-led processors to comply with the international standards, the Lin'an Forestry Bureau and the LBSPA helped processors to link up with hazard-free production producers to assure the fulfilment of the required production and processing standards.

[38] The ISO 9001:2008 and ISO 9001: 2000 are two major standards for bamboo shoot quality management include the produce measurement, analysis and improvement, and quality control of the fresh shoot products.

[39] The China Quality Certificate Centre monitors the bamboo shoot processors to assess whether they are capable of establishing critical points in the production and processing processes to monitor chemical usages and hazards. If processors are capable of monitoring and preventing those physical, biological and chemical hazards; they can obtain the HACCP certificate (Asia Green Agriculture Corporation, 2010, p. 14).

7.3.2 China's standard on local-led processors and small processors

In Lin'an County, the Product Quality Monitoring Group in Lin'an Forestry Bureau, Technological and Science Bureau, Quality Control Bureau, the Zhejiang Agricultural and Forestry University, and agri-business firms develop particular sets of bamboo shoot production and processing standards to maintain the internal market and maintain quality of bamboo shoots for processing. These standards involve cultivation experiences (required standardised trainings, fertiliser application, and pest and controls), taste expectations (freshness and texture), presentations (i.e. colours, size, and appearances); artisan skills (equipment to dig up the shoots and skills to cut off the root parts). The Lin'an state wants to use the collaboration among processors, research institutions, demonstration households, and individual farmers to achieve food quality and assurance system (Xu et al., 2008).

Bai et al. (2007) categorises bamboo shoot assurance systems in Lin'an County into two major aspects: (1) compulsory food safety admittance systems which include the Food Quality Safety Market Access System (FQSMAS) which is enforced by the General Administration for Quality Supervision, Inspection and Quarantine (AQSIQ) (see Table 18), and (2) voluntary food admittance system include two major standards: (1) hazard-free shoot production standard (DB33/333.3-2006) and (2) green shoot production standard (NY/T1048-2006). The Forestry Bureau also stipulates its own standard: Mountain Food Production Standard to regulate the raw materials for the bamboo processing industry (see Table 18 and 19). Both the compulsory and voluntary systems have similarities and even overlap in terms of functions and roles in regulating the using of fertilisers, issuing permits, and testing residue in Lin'an County (Xu et al., 2008).

Table 19 Comparison of Three Different standards for bamboo shoots

Items	Hazard-free shoot production standard	Green shoot production standard	Mountain food production standard
Year established	2001	1990	2007
Permits genetically modified organisms	Yes	Yes	Yes
Permits synthetic fertiliser and pesticides	Yes	Yes (only some kinds of chemicals are permitted)	Yes
Residue testing	Yes	Yes	Yes
Initial force Certifiers and costs	Ministry of Agriculture Centre for Agri-Food Quality and Safety: no certificate fee	Ministry of Agriculture Centre for Agri-Food Quality and Safety: RMB 10, 000	Ministry of Agriculture Centre for Agri-Food Quality and Safety: no certificate fee
Traceability	No	No	No
Period of validity	Three-years	Three Years	Three Years

Note. With reference to Scott et al*.,* 2013

To understand the effectiveness of the local state to regulate processors to comply with both international and national production and processing standards, the chairman of the Bamboo Shoot Processing Association Mrs. Yu comments:

> Mostly, the local-led processing firms can fulfil both national (e.g. hazard-free standards) and international standards (e.g. HACCP) because their products have to sell to international markets and there are stricter food quality control and assurance system. For instance, the Japanese food quality is very strict; if the Japanese custom found a hair in any bamboo shoot products, the whole container has to shift back to China. For internal market, monitoring is a problem because we cannot safeguard those small processors to comply with hygiene and chemical usages standards because most of the small processors are operating in a household-based. The most pressing issue for our Association is to regulate those preserving shoots processers because they used toxic preservative to extend the quality of the shoots and Our association had taken action to express our opinions to local township government (Interview with bamboo shoot association chairman, P02, 2012).

From the chair's comment, the local-lead firms are capable to comply with both national and international standards because of stricter customers' demand. However, the quality assurance of bamboo shoot system in Lin'an cannot effectively to monitor all small processors' products to comply with the national standards. Although the Lin'an state demonstrates institutionalisation of bamboo shoot processing standards; it is only confined to small portion of the bamboo shoot processors. The practices of standardisation and impact of quality assurance system still takes time to diffuse from leading firms to other processing industries.

7.4 Fresh Bamboo Shoot Market in Lin'an County

The scale of the bamboo shoot production in Lin'an is the biggest hub in Zhejiang province and in the south-eastern part of China. This section examines how the Lin'an state managed the market in two levels of analysis: (1) analysis of how priced is managed and how bamboo shoot farmers perceived the market prices; (2) examines the effectiveness of the market channels to absorb the overproduced shoots.

There are price and product differentiations between high-value and low-value fresh *Ph. Praecox* bamboo shoot markets. There are three major factors, which can affect the market prices of the *Ph. Praecox* bamboo shoots:

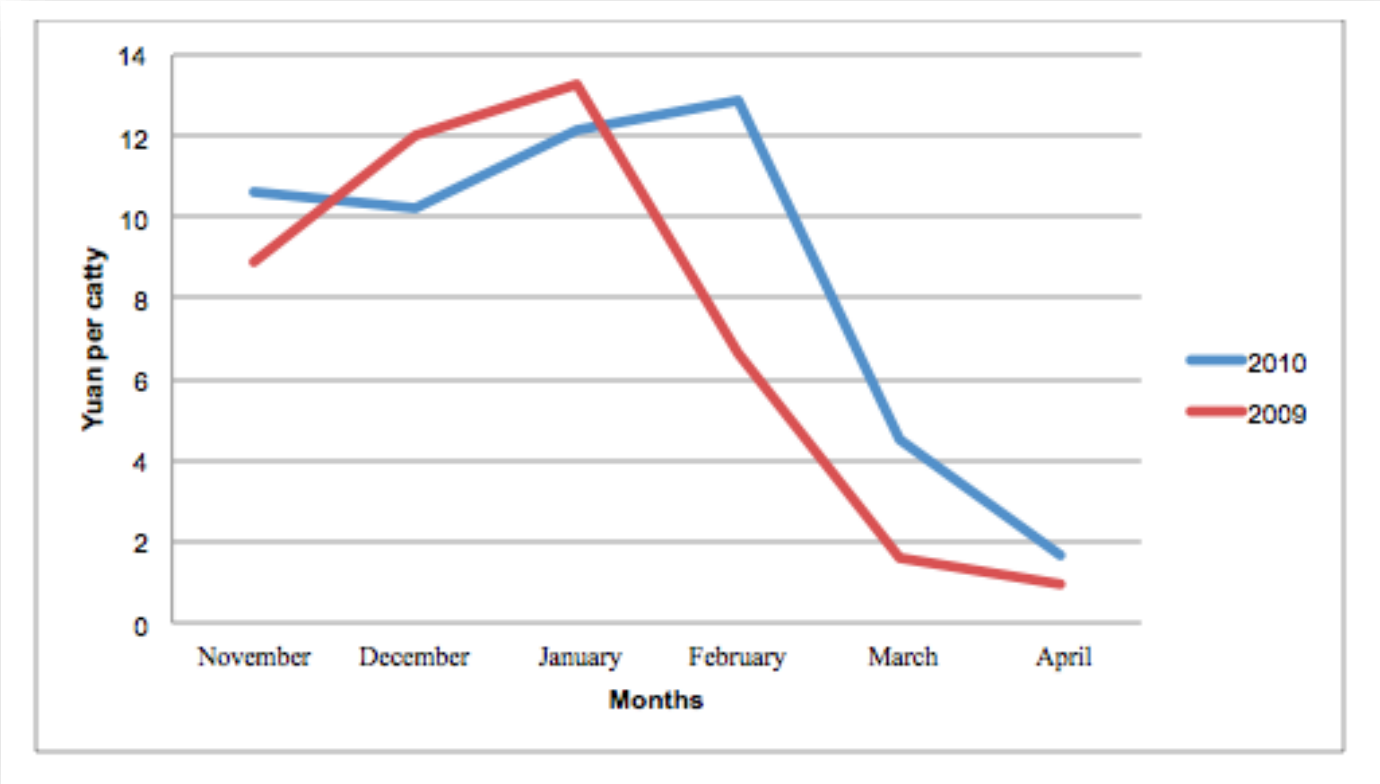

Figure 41 Market Prices of Ph. Praecox Shoots in Lin'an Qingyun and Yuqian Markets

(Source: Lin'an Forestry Bureau, 2012b)

7.4.1 Seasonality, market demand and supply

The prices for the early shooting praecox shoots are the highest before and after the fourteen days of the Lunar New Year. In 2010, the Lunar New Year was on 14th February; the average price of the fresh *Ph. Praecox* shoot was the highest 12.88 Yuan per catty at that year time, while the Lunar New Year in 2009 was on 26th January; the average price 13. 28 was also among the highest

through that year (see Figure 41). The market price data validates two major market phenomenon: (1) the market demands on the fresh *Ph. Praecox* shoots were high during the Lunar New Year and the prices are the highest among the whole year transaction; (2) From the supply-side high market prices attracted producers to adopt the early shooting technique for the purpose of reaching the higher value segments of the markets. Famers who can grow the off-season *Ph. Praecox* shoots before and after fourteen days attain higher premiums and greatly improved their income.

7.4.2 Negotiations and determinations of the market prices

The interactions between the Shanghai Hang Tai Bamboo Shoot Trading Market wholesalers (buyers) and middlemen (See section 7.4.5) from Lin'an County (sellers) negotiate the specific prices are as follow. The market prices of fresh bamboo shoots respond to the demand and supply. There is unbalance market information between bamboo shoot middlemen in Shanghai, small-scale intermediaries and producers in Lin'an. For instance, when the bamboo shoot middlemen know the market prices in Shanghai, they will report to the small-scale intermediaries in the bamboo shoot market in Lin'an through mobile phone conversation. After the small-scale intermediaries know about the prices, they will report to the farmers by a face-to-face visit and pay the cash for bamboo shoots to farmers. There is asymmetrical market information between the producers and intermediaries if the producers do not learn the daily market price by their own methods. To maximize the price premium, farmers have to consider two major strategies: (1) to access the price discovery process by using their experiences and relationships with the small intermediaries to bargain for higher prices (Brown et al., 2008, pp. 205-206), (2) to increase per unit the value of bamboo shoot productivity and reduce production costs. Brown et al., (2008, p.205) commented, "The existence of various marketing channels and market conditions

and practices mean that some households do not receive fair value for their outputs given the general level of prices in the market."

7.4.3 Market information

For the fresh *Ph. Praecox* bamboo shoot market networks, there are 5, 000 market traders[40] who work in 12 township level fresh bamboo shoot markets in rural Lin'an to trade and transport the fresh shoots to the wholesalers in the urban Shanghai Putong *Hang Tai* fresh shoot trading market and other fresh shoot trading markets in Nanjing, Suzhou and Wuxi (Lin'an Forestry Bureau – China's bamboo village report, 2006). Fresh bamboo shoots in Lin'an are harvested from November to May. According to the Chinese custom, bamboo shoot which are harvested before March are called "winter bamboo shoots", and those harvest after March are called "spring bamboo shoots" (Asia Green Agriculture Co-operation, 2010). The winter bamboo shoots (early shooting *Ph. Praecox* shoots) in Lin'an are high input and higher in price when comparing to the spring bamboo shoots (natural shooting *Ph. Praecox* shoot).

In rural Lin'an, there are four major bamboo shoot markets: (1) *Qing Yun*, *Yu Qian*, *Yang Ling* and East *Timanu* bamboo shoot markets. The sizes of these markets have extensive areas with more than 8,000 square meters and available to accommodate 200 stalls (He and Tong, 2006). There are also 600 large-scale bamboo shoot middlemen who live adjacent to the *Qingyun* and *Yang Ling* markets. In 2012, the total transactions of the two largest bamboo shoots trading markets – *Qing Yuan* and *Yu Qian* are illustrated in table 20 below.

[40] These include small-scale intermediaries, large-scale middlemen and transport handlers

Table 20 Total Transactions of Two Bamboo Shoot Markets in 2012

Total transaction (10,000 catty)	134,938,200 Yuan
Average transaction price	2.78 Yuan/ Catty
Total transaction values	375,071,400 Yuan
Fresh shoot from local producers for processing industries in Lin'an	70,230 Tons
Fresh shoots from other provinces for processing industries in Lin'an	20,040 Tons

Source: Lin'an Forestry Bureau, 2012b

These transaction values imply an enormous value added process and also lucrative income for bamboo shoot traders and transporters. However, bamboo shoot producers have to face fluctuated price.

According to this research's survey, which conducted with 56 bamboo shoot farmers, the majority of farmers (78. 2%) pointed out that the prices of the fresh bamboo shoots fluctuated and only 21.8% of the farmers think that the prices are stable. A typical farmer Mr. Liu commented was that:

> The prices are fluctuated. Sometimes, the highest price is more than 20 Yuan per catty. With early shooting technology, the *Ph. Praecox* shoot can sell for more than 70 Yuan per catty before the Lunar New Year. When the price is high, the *Ph. Praecox* shoot becomes the "winter vegetable." However, for a natural shooting shoot, it sells 0.8 Yuan per catty, which is very cheap (Interview with bamboo shoot farmers F01, 2012).

Farmers feel very unstable and transient when the prices fluctuated. Another farmer Mr. Yu commented, “I don’t like the prices which always go up and down because of the farmers’ lack of bargaining power to negotiate the price with the middleman and lack of market information (Interview with bamboo shoot farmer F15, 2012).” Taking into consideration these farmers’ comments, price fluctuations increase their risks in the investment (e.g. fertilisers, chicken deposits, and covering materials) on the early shooting *Ph. Praecox* shoots. On the other hand, the oversupply of natural shooting *Ph. Praecox* shoot cause the very low price. With a huge supply of natural shooting bamboo shoots, processing industries become an important media to digest the perishable bamboo shoots and transform them into processing products.

7.4.4 Small-scale intermediaries

Many middlemen originally cultivated bamboo shoots as their experience and income increased, moved into more profit-making bamboo shoot distribution and marketing. Some middlemen, who worked as drivers during the central planning era in the 1970s, specialised in bamboo shoot logistics. Some of them hauled mountain grown vegetables to the vegetable markets in the big cities. Consequently, they are more familiar with the wholesalers in Shanghai and Hangzhou. Bamboo shoot producers, small-scale intermediaries and large-scale middlemen will negotiate the prices of the fresh bamboo shoots depending on five major factors: (1) size: big, large, and small, (2) length: long and short, (3) appearance: good shape without blemishes, (4) freshness: does not deteriorate and produce a bad smell, (6) low soil content.

The early shooting shoots are the high value market segment with premium price and profit margins because of the shortage of fresh shoots and vegetables during the winter seasons; while the natural shooting *Ph. Praecox*

shoots are the low market segment with lower profit margins because of the oversupply during the shooting period between late March to May every year. To maintain the quality and price of shoots in the high market segment, in 2012 the Lin'an Forestry Bureau has institutionalised a grading system for processors and market traders to make transaction. There are three major grades for the *Ph. Praecox* shoots in the fresh shoot market as shown Table 21 below.

Table 21 Grading system of *Ph. Praecox* shoots in Lin'an

Grades of the *Ph. Praecox*	**Weight (gram)**	**Length (cm)**	**Edible part and Soil content (%)**
Top grade	150-400	20-30	Edible part more than 65% and less than 2 % soil content
First class	Over 400	30-40	More than 60% is edible and soil content should less than 2%
Second class	100-150	≤ 20 or ≥ 40	Edible part should more than 55% and soil content should less than 2%

Source: Lin'an Forestry Bureau, 2012

For the fresh *Ph. Praecox* shoots, there are two different seasonality: early shooting of *Ph. Praecox* for off-season (November to late February) and natural shooting (March to early May) *Ph. Praecox* shoots for on season. Middlemen earned more money by selling the fresh early shooting *Ph. Praecox* shoot because of higher market value during the bamboo shoot off-season from December to late March every year. Under the market demand and supply mechanism, the price is higher when the bamboo shoot products are in lesser quantities.

To reach the premium market, and obtain the top and first class grades *Ph. Praecox* shoots, small intermediaries intermediaries will depend on three major strategies to secure high quality shoots: (1) based on their experiences to establish a private treaty with individual farmers in terms of price and quantity.

They will have to pay higher prices to secure high quality shoots. Small intermediaries will give a call to bamboo shoot farmers to reserve those high quality shoots for them based on the negotiated prices (estimated market values based on the intermediaries' experiences) and trust, (2) depends on their geographical relationships to start their shoot collection from their own villagers and then spread to nearby villages; (3) collaboration with other small intermediaries can create a synergy effects to increase the opportunity to collect more high quality shoots based on their own personal networks and share the market risks. More importantly, bamboo shoots are perishable and pairing up with other intermediaries can increase the time and space efficiency to maintain premium price value in the supply chain and facilitate the transaction in time (before and after fifteen days of Lunar New Year). One intermediate Mr. Jin commented, "I earn more through the price differences, every day is just like gambling which depends on personal judgments, sensitiveness to market prices and the relationships with farmers' households. The higher premium prices of the bamboo shoots are closer to the Lunar New Year (Interview with bamboo shoot intermediate M01, 2012)." Once the intermediaries collect the shoots from farmers, they will do some initial processing by removing the soil and outer shell of the shoots by cutting-off the base part and resining it. Intermediaries will depend on the weight, length and appearances of the shoots to classify and pack them into three different grades of bamboo shoots (see Table 22). The reason why the size and weight of bamboo shoots is standardised is because large-scale middlemen required them to pack it into standardised plastic packages e.g. 10, 20, 30, 40, and 50 catty per package.

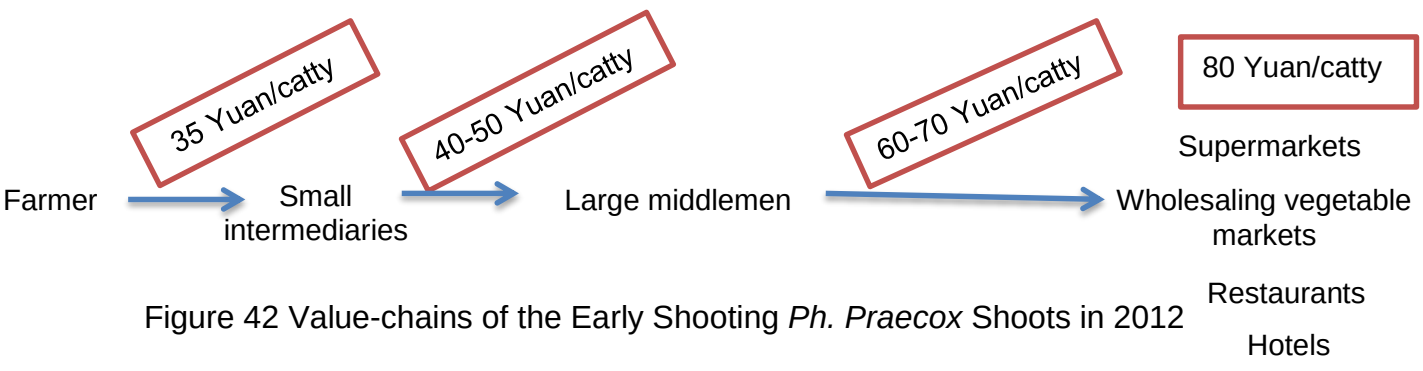

Figure 42 Value-chains of the Early Shooting *Ph. Praecox* Shoots in 2012

According to intermediaries, the market prices fluctuate and approximate the general high price for the early shooting *Ph. Praecox* shoot in the value chain at around 10 to 15 Yuan per catty in the high market segment in 2012 (see Figure 41). According to one small intermediate information, the revenue per catty is around 13 Yuan and the gross profit margin are 13,400 Yuan per day and 89 %respectively IN 2012 (see Table 22). The calculation is based on the intermediaries' approximate estimation for the price differences between the purchasing prices from the large-scale middlemen.

Table 22 Profit Margins of Small Intermediaries in a High Market Segment

Revenues	
1, 000 catty multiply 15 Yuan (price differences) for urban wholesaling market	15, 000 Yuan
Costs	
1.Transport cost 300 Yuan per day multiply 2 vehicles	600 Yuan
2. Worker wages 10 Yuan multiply 10 hour multiply 10 workers (for primary processing)	1000 Yuan
Gross profit per daily transaction	13,400 Yuan
Gross profit margin per daily transaction	89%

Source: in-depth interview with a small intermediate Mr. Jin M01, 2012

The natural *Ph. Praecox* shoot prices (1 to 0.5 Yuan) are very low when compared with the early shooting shoots (35 Yuan), the natural *Ph. Praecox* shoots are mainly for processing because this is the time for processors to

secure the processing materials for year round processing. During the natural shooting periods from March to early May, processors will post their daily prices range from 1 to 0.5 Yuan outside factory gates (see Figure 43). Some processors follow the market prices but most of them will base on the protection prices 0.5 Yuan per catty to maximize their profit margins.

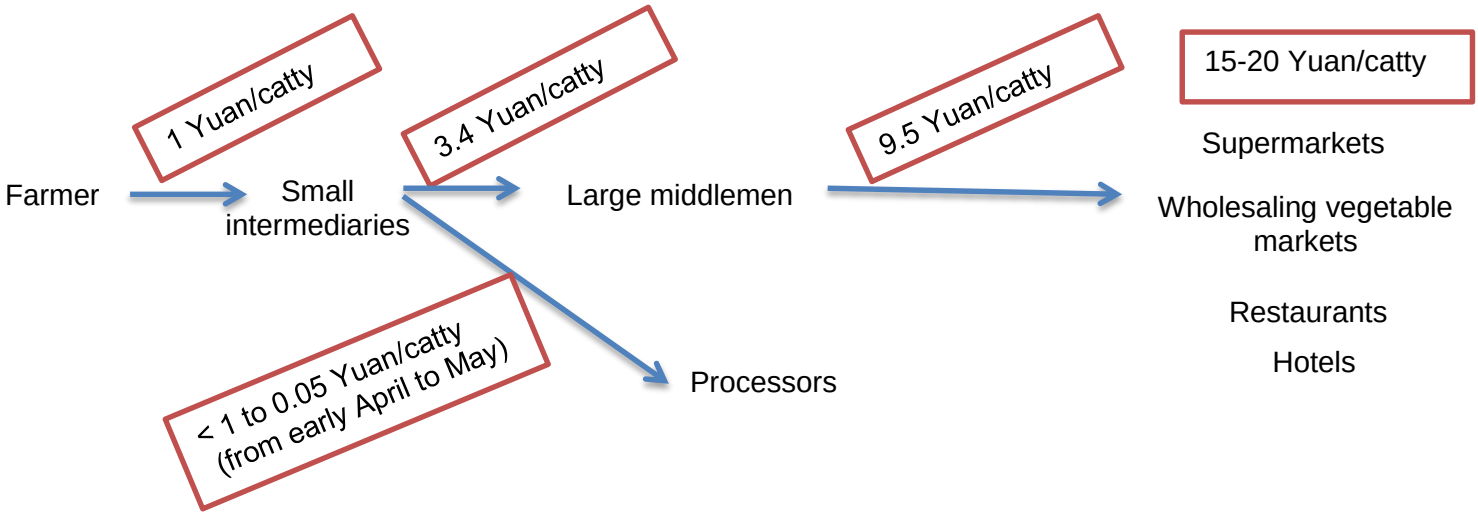

Figure 43 Value-chains of the Natural Shooting *Ph. Praecox* Shoots in 2012

Taking the advantages of the perishability of natural shoots, bamboo farmers and intermediaries have to find the right processors within 1 to 3 days of harvesting otherwise their shoots will be rotten and greatly reduce the values. Again, different processors have different requirements on the size, length and types of shoots for processing. However, most of the Lin'an processors processed *Ph. Praecox* shoots for canned boiled shoot, preserved shoot, seasoning, and dried shoot products. Intermediaries have to secure their profit margins by selling to the urban wholesalers' markets such as Shanghai in order to safeguard the higher price margins. Intermediaries will try to sell most of the fresh shoots to large scale middlemen and sell their shoots in the urban wholesalers markets. The intermediaries will collect the shoots and mainly sell to the bamboo shoot processors (the amount of the shoots provided for the processors various on a daily basis). The protection price for the bamboo shoot

farmers is 0.5 Yuan per catty for the protection prices in the Lin'an (see Table 23), if we use the lowest prices to calculate the profit margin; they are around 45% (see Table 23) given the fact half of the fresh shoots are selling in the urban wholesalers market for 3.4[41] Yuan per catty (relative higher price segment) and half for the local processors 0.5 Yuan per catty (lowest price segment) (see Table 23).

Table 23 Profit Margins of Small Intermediaries in a Low Market Segment

Revenues	
1,000 catty multiply 0.5[42] Yuan (price differences) for processors	500 Yuan
1,000 catty multiply 2.4[43] Yuan (price differences) for urban wholesaling market in 2012 (The interviewed intermediate has a basic 2,000 catty shoots' collection capacity)	2,400 Yuan
Costs	
1.Transport cost 300 Yuan per day multiply 2 vehicles	600 Yuan
2. Worker wages 10 Yuan multiply 10hour multiply 10 workers (for primary processing	1,000 Yuan
Gross profit per daily transaction	1,300 Yuan
Gross profit margin per daily transaction	45%

[41] The price 3.4 Yuan is an average price between March (5.83 Yuan) and April (0.94 Yuan) in 2012 (Lin'an Forestry Bureau, 2012b).
[42] The protection prices are used by the processors in the Lin'an county
[43] The interviewed intermediaries provided the information about the purchasing prices for the bamboo producers as 1 Yuan and the purchasing prices in the bamboo shoot market as 3.4 Yuan. The price difference that the middlemen can earn is 2.4 Yuan per catty.

Source: in-depth interview with a small intermediate Mr. Jin M01, 2012

7.4.5 Large-scale middlemen

There are around 300 large-scale middlemen actively participating in bamboo shoot trading from November to late May every year in *Qing Yun* bamboo shoot trading markets (Interview with market trader Mr. Yu M02, 2012). Among these 300 large-scale middlemen, there are around 30 middlemen who came from other provinces; these middlemen employ local intermediaries to buy the shoots from farmers because they have a lower sense of geographical belongings to the Lin'an County. The bamboo shoot trading market is opened from 8 a.m. to 4 p.m.; while the large-scale middlemen started transport their purchased bamboo shoots from 10 a.m. to 9 p.m. These large-scale middlemen have their own trucks to transport shoots from *Qing Yun* market to the bamboo shoot trading market in Shanghai and other vegetable wholesaling market in Jiangsu, Lingpo, Wuxi and Beijing. The large-scale middlemen's trucks can haul 50 tons of bamboo shoots per trip.

There are around 2,000 Lin'an workers and around 100 workers from other province who are employed by the middlemen to work in the market. There are four major roles for the market workers: (1) unloading bamboo shoots from the small intermediaries and uploading bamboo shoots on the trucks, (2) cutting the base part of shoots and peeling off the out shoot husks; (3) classifying bamboo shoots into two major categories of sizes and lengths, and (4) packing the bamboo shoots into four major categories; namely (a) large size, (b) medium size, (c) small size, and (d) mixed size and among each category there are 10, 20, 30, 40 and 50 kilograms packages.

By analysing the value creation in the fresh *Ph. Praecox* bamboo shoot's supply chain, there is uneven distribution of economic benefits, bamboo shoot

farmers not only encounter unpredictable profit margins but also obtain the lowest value-creation in the supply chain when comparing to intermediaries and large-scale middlemen. Additionally, both market price fluctuation and soil degradation further increase bamboo shoot farmers' vulnerable economic positions. From the market segment analysis, there is a large price gap between early and natural shooting *Ph. Praecox* shoot; farmers can make a better income by applying the early shooting technology. The market segment drives farmers to maintain high productivity and intensity bamboo shoot production model by applying plenty of fertilisers and covering materials to their bamboo shoot plantations. Furthermore, Lin'an is the largest hub of bamboo shoot transaction in China and a big marketing sector implies a huge demand on bamboo shoot resources to create economic values. To a certain extent the marketing sector of the bamboo shoot industry can help farmers to sell their shoots to urban markets; however, the problem of over-depending on Lin'an bamboo shoot production sector to sustain the marketing sectors will increase the ecological burden of the bamboo shoot production system.

7.5 Rethinking sustainability

Since the mid-1990s, the Lin'an state put forward a bamboo resource-based model of development, promoting the concept of "sustainable development", which it envisioned as economic development in perpetuity with bamboo shoot production, unhindered by the environmental limits of the ecosystem through applying new technology, rationalise land resources and further development of the secondary industry and marketing sectors to tackle the overproduction problem. This model of sustainability stresses on pro-growth mentality and material needs of local people by increasing the capacity of bamboo shoot cultivation.

The deputy head of the Lin'an forestry bureau commented:

> Now bamboo is a money tree to transform farmers' mentalities from cutting trees to protecting trees, from challenging nature to enjoying nature, with the effort of government policies and farmers' participation, the per capita annual income 11,910 Yuan derived from non-timber forest products greatly improved farmers' livelihoods…the sustainable development of bamboo shoot production in Lin'an County provides a successful example to solve logging problems and improving farmers' livelihoods in Lin'an countries (The prologue of the deputy head in "Integrated Sustainable Development in Mountain Areas and Non-Timber-Forest-Products Development", 2011).

From the deputy head's analysis, bamboo is regarded as money tree. Growing this money tree drives a positive environmental transition from logging to forest conservation in Lin'an County. The above comment implied two major messages: first, economic development (e.g. growing bamboo) is compatible with environmental conservation (e.g. reducing logging and increasing forest coverage rate); from 1995 to 2006, the bamboo forest increased 180, 000 ha and rejuvenated 5.8 % of slope lands and wastelands in Lin'an County (Ho, 2007, p.2). Second, once farmers earned money from bamboo shoot; this will reduce logging (See also in Chapter four). In total, there are around 65, 000 bamboo shoot farmers who earned more than 5, 000 per capita income annually which accounted for 60 % of the total agrarian population (around 108, 000 farmers) in Lin'an (He, 2007). The economic incentive to grow bamboo shoot had reduced farmers' wood logging activities in Lin'an since the 1980s. From the deputy head's account, its offer a puzzle for this research to understand how and to what extent bamboo cultivation in the post market reform can bring sustainability to the Lin'an County? It is because the deputy head's comment only partially covered part of the sustainable development story in Lin'an County. The story about unsustainable practices of using plenty of fertilisers and pesticides to manipulate the bamboo shoot ecosystem and the perception of farmers in Lin'an County were not covered.

To better understand how farmers perceive the meaning of sustainable development of the bamboo shoot production industry, this research conducts a survey with 56 farmers to understand their perception about the concept of sustainable development, the majority (54%) of farmers said they heard about this concept before; 46% of farmers haven't heard about it before. To better understand how the majority of farmers understand the concept of sustainable development, a further interview was conducted with those farmers who understood this concept to elaborate on their meanings. Although bamboo shoot farmers provide a diverse understanding of the sustainable development of the bamboo shoot production industry, this research summarises four major types of perceptions toward the meanings of sustainable development below.

Depending on technological innovation and cleaner ways of production to achieve sustainable development

A bamboo shoot farmer Mr. Liu understands, "Sustainable development as a positive direction of development. This positive development emerges when farmers are willing to use organic fertilisers to replace the usages of chemical fertilisers on our lands; this demonstrates that our bamboo shoot plantations look greener and reduce the accumulation of chemical substances in the soil (Interview with bamboo shoot farmer F05, 2012)." From the above comment, Mr. Liu realises that using plenty of chemical fertiliser will pollute the soil in Lin'an county. He sees the cleaner way of production is a method to fix the soil degradation and achieve the positive direction of development. Another bamboo shoot farmer Mr. Zhang comments, "Sustainable development means economic-centred development plus wise use of science and local government's planning to utilise bamboo shoot resources (Interview with bamboo shoot farmers F19, 2012)." From Mr. Zhang's comment, he believes that technological innovation with government guidance can help bamboo shoot farmers to rationalise the use of bamboo shoot resources to sustain the economic value creation. This type of

perception is focusing on using technology innovation to bring sustainability for the bamboo shoot production industry.

Emphasises economic sustainability and trickle down resources to improve environmental conditions

Bamboo shoot farmers Mr. Wu comments, “Sustainable development can bring farmers with stable income from bamboo shoot cultivation and increase our motivation to protect the forest environment because my next generation needs to sustain their economic interests (Interview with bamboo shoot farmers F12, 2012). ” From Mr. Wu’s comments, economic interest is important momentum for him to concern on the forest environment, which implies that economic rationality driven farmers to protect the forest environment. Bamboo shoot farmer Mr. Chen also comments, “I understand sustainable development as a way to produce more resources to improve my income. Basically, money is the major factor to influence farmers to protect the environment (Interview with bamboo shoot farmer F13, 2012).” Mr. Chen’s perception represents a type of perception that economic rationality is a driving force to influence farmers’ behaviours to protect the forest environment.

Concerns the economic sustainability of next generation

Bamboo shoot farmer Mr. Xie comments, “Sustainable development is a way of living to depend on the mountain and eat the forest products derived from the mountain. I am near to my retirement age, I have to consider the interests of next generation and protect the forest resources for them to sustain their economic needs (Interview with bamboo shoot farmers F14, 2012).” From Mr. Xie’s comment, he has a moral concern for the next generation to use the bamboo materials to satisfy their material needs.

Both economic development and environmental conservation is compatible

Mr Xiao comments that “sustainable development means I grow bamboo shoot to earn my living and meanwhile I make the environment greener (Interview with bamboo shoot farmer F06, 2012).” Another farmer Mr Huang understands sustainable development as a way to create a “better living environment and it provides more attractiveness of my farm stay for tourists from Shanghai (Interview with bamboo shoot farmer F28, 2012).” Two farmers acknowledged that the sustainable development means both economic development and environmental conservation is complementary.

Although most of the farmers concerns about economic sustainability and material welling derived from the forest environment, they also show their moral concerns on the next generation to use the bamboo resources and needs to conserve the forest environment. On the one hand, bamboo shoot farmers need to depend on bamboo shoot cultivation to obtain money and material welling; on the other hand they realised that soil degradation will threaten their livelihoods. Chinese Anthropologists Fei Xiao Tong comments “Only those who make a living from the land can understand the value of land (Fei, 1992).”

7.6 Discussion of the role land re-organisation, institutionalisation of standards and the establishment of economic partnerships

Situating the debates on land re-organisation, institutionalisation of processing standards and the role of the market among ecological modernists, eco-Marxists and political ecologists allows this research to examine the effectiveness of the local state to utilise bamboo shoot resource to sustain economic growth and mitigate environmental degradation. For instance,

Ecological modernists address how the Lin'an state co-operates with demonstration households, bamboo shoot processors and market traders to rationalise bamboo shoot resource management (Economy 2006; Ho 2006). Through the institutionalisation of processing standards and the utilisation of human capital, including labour and their artisan skills, local farmers are capable of mitigating environmental degradation and economic development in Lin'an's development model. For instance, the local state establishes partnerships with non-state actors to mitigate the negative environmental impacts of bamboo shoot production by establishing production and processing standards (Bai et al*.,* 2007; Boström and Klintman, 2006). However, eco-Marxists and political ecologists are doubtful about the effectiveness of land re-organisation and partnerships between the local state, processors and market traders to ameliorate environmental degradation in Lin'an County. First, from their perspective, land re-organisation is just an economic means to commodify bamboo shoot resources. However, the local state has not solved the problem of over-exploitation of bamboo shoot resources to sustain unfettered capitalist growth (O' Connor, 1998). Second, there is an uneven distribution of economic benefits arising from bamboo shoot cultivation in Lin'an County. For instance, bamboo shoot farmers find themselves in a marginalised economic position when their bamboo shoot plantations are degraded; their marginalisation is reflected by their limited bargaining power in price negotiations. Therefore, political ecologists question the effectiveness of establishing partnerships as a means to benefit farmers and nature. For them partnerships extend the arm of state to extract more bamboo shoot resources and tap more social capital out of Lin'an farmers, and this will result in ever more uneven distribution of economic benefits and environmental harms (Blaikie and Muldavin 2004; Yeh, 2009).

7.7 Conclusion

Bamboo shoot products have become an integral part of mountain economy in Lin'an since the 1990s. The Lin'an state used policy and price instrument to integrate production, processing and marketing sectors of the bamboo shoot production industry to (1) rationalise and re-collectivise the fragmented land resources through land transfer, (2) fix the overproduction problem and institutionalise processing standards to help processors to comply with international and China's food production standards. Through studying the empirical data, this chapter concludes that land re-collectivisation is full of challenges because of divided and protective mind-sets of bamboo shoot farmers. Although the Lin'an state tried to increase the industry integration cannot to absorb those oversupply natural shooting *Ph. Praecox* shoots, the limit of processing capacity, price gap between early and natural shooting of shoots, and the pro-growth mentality drive the processing industry cannot absorb those bamboo shoots. Additionally, although the Lin'an state demonstrates institutionalisation of food production and processing standards; however, it is only confined to small portion of bamboo shoot processors. The practices of standardisation are fragmented and the impact of quality assurance system takes time to diffuse from leading firms to local small processing firms. Finally, there are asymmetrical information, uneven distribution of benefits in the bamboo shoot value chains which increase farmers' vulnerability in economic position. Farmers not only lack of bargaining power in the value chain but also suffer from price fluctuation. By evaluating the governing objectives and implementation of land re-collectivisation, standardisation of processing industry, and non-state's actors interactions in the bamboo shoot market segment, this research argues that the local state tries to utilise and tape more bamboo shoot resources to increase the economic value creation in the bamboo shoot processing and marketing sectors which rather than just absorbing the over-produced bamboo

shoots. This model of sustainability in Lin'an bamboo shoot production industry still stresses on pro-growth mentality and material needs of local people by increasing the capacity of bamboo shoot cultivation. In the next chapter, a further reflection the sustainability of this bamboo shoot based development model will be further discussed.

CHAPTER EIGHT: CONCLUSIONS

8.1 Introduction

Through the theoretical lens of ecological modernisation, eco-Marxism, and political ecology, this research aims at examining how the role of local state and non-state actors tackle the dilemma of economic development and environmental conservation to achieve sustainable development. Integrating the theoretical insights of ecological modernisation, eco-Marxism and political ecology provides an appropriate conceptual framework to examine China's local dynamics and complexities in a particular time and space. This research reflects on the value and complimentary role of these three theoretical lenses in the conclusion. In terms of theoretical traditions, these three theories develop from different traditions. For instance, eco-Marxism develops from Hegelian critical theory and dialectical reasoning; while ecological modernisation is developed from environmental sociology and reflexive modernity. Rather than trying to reconcile their theoretical differences, this research sees these three theoretical approaches as integrative "spotlights" to critically examine China's environmental transition at the local level.

8.2 Reasons to adopt an integrative approach

There are five major reasons to adopt an integrative approach. First, it continues the theoretical conversation between ecological modernisation, eco-Marxism, and political ecology to discuss how the roles of the state, technology, market and civil society help China to search for a sustainable development pathway. For instance, eco-Marxism provides reflections on the impacts of human-domination of nature (e.g. commodification of nature); while ecological modernisation provides an understanding of how the growth of environmental awareness can increase public pressure to propel the institutionalisation of environmental practices in both public and private sectors. From a political ecology perspective, there are insights into how developmental projects caused ecological degradation and social marginalisation. By integrating these approaches to analyse China's sustainable development, we get a more comprehensive picture of the complexities and dynamics surrounding how local state and non-state actors perceive bamboo nature, the rise of civil society and the consequences of social marginalisation in the bamboo shoot production industry.

Second, this integrative approach throws into sharp focus key issues of current debates. For example, in the debates on the role of technological innovations; ecological modernisation emphasises the role innovative technologies including cleaner production and material recycling technologies play. However, eco-Marxists are dubious on the use of technology to tackle environmental problems because more technology means more resource exploitation and wastage. To bridge the division between ecological modernisation and eco-Marxism, the relational thinking in political ecology helps to consider the "co-functionality" and "co-production" potentials among nature-human-technology relationships. For instance, by integrating the political ecology perspective to consider human-bamboo-technology relationships it enables us to

reconsider bamboo resources in three new ways: (a) discover the potential and complexity of involving bamboo as a bio-techno fix such as carbon sequestration, to tackle rural poverty and as a substitute wood; (b) realise the co-functions of heterogeneous human and non-human actors (e.g. chemical fertilisers and new propagation technology) to produce bamboo forests in different times and spaces; and (c) be aware of multi-scalar interactions among biotic and abiotic actors (e.g. overusing of chemical fertilisers can increase the accumulation of toxic chemicals) will transform the scales, regions and territories of bamboo forests.

Third, this integrative approach opens up a future research agenda by exploring the biophysical and bio-economical capacities of bamboo to create positive feed-back loops: (1) by exploring the socio-ecological practices of carbon sequestration, (2) by examining zero-waste in bamboo material processing, and (3) by understanding how the materiality of bamboo transforms the daily practices and spirituality of Chinese people in both rural and urban settings. These perspectives go beyond the adaptation and mitigation perspectives that are dominating much thinking in Chinese environmental debates by proposing a new mode of theorising forest changes with the concepts of scales and linkages, technical and co-constitutive logics. These can identify the in-betweeness of bamboo nature and technology, innovations and instruments to seek for socio-ecological solutions. A more geographically informed research agenda raises a number of key research questions including: What are the arrays of human and non-human actors that co-produce bamboo production technology, knowledge and material to mitigate climate change? What kinds of politics co-function between human and bamboo nature to privilege and exclude certain actors? What are the perceptions of state and non-state actors in their understanding of bamboo as a socio-ecological solution to solve environmental problems in China?

Fourth, there is available empirical data to answer enquiries from an integrative approach. For instance, the longitudinal forestry transition database from INBAR and the Lin'an Forestry Bureau can be used to progress ecological modernisation ideas, for instance, by examining whether land re-arrangement from the rural collective to individual farmer can reduce deforestation. In-depth interviews data were obtained from farmers and local state officials' perceptions enabled crosschecking whether on land re-arrangement can reduce soil degradation and social conflicts. The availablility of soil degradation and social conflicts data can be helpful to answer both eco-Marxism and political ecology's enquiries.

Fifth, a more integrative approach also answers the central research questions:

(1) How do the state and non-state actors govern the bamboo shoot production industry?
(2) How do the co-existence of both state-centred and multi-nuclei governance structures promote sustainable development policies in the bamboo shoot production industry?
(3) How does the local state create an environment in which multiple actors struggle over low household incomes, environmental degradation, and integration of industry sectors?

To answer the first research question, Chapter Two examines the meanings, structures, and processes of governance, highlighting the rich conceptual understandings, diverse forms of mechanisms and dynamics actors' interactions in governing processes. By taking Davidson and Frickel's (2004) argument further by integrating the debates among ecological modernisation, eco-Marxism, and political ecology in environmental governance to address (1) China's complex and dynamic ecological challenges at the local level. There are three major conceptual impacts by integrating these insights:

First, it provides a holistic analysis of both top-down delegation and bottom-up implementation of sustainable development policies. It integrates both state actors' perceptions and farmers' voices and combining both statistical data with micro ethnographic analyses in a specific spatial and temporal context (see Chapter Three). In particular, it helps this research to conceptualise the environmental values of bamboo shoot farmers by understanding how they interacted with the lived experiences of bamboo shoot cultivation, land degradation, and privatisation of land resources. This research found that farmers did show their moral concerns on the soil degradation, occurrence of pests and disease problem and improper use of fertilisers. The concerns of farmers show a contrasting view to the post-material thesis that people in developing countries are mainly concerned about materialistic development and show little sympathy to environmental conservation (Inglehart, 1997). However, Lin'an bamboo shoot farmers are sympathetic to environmental degradation because soil condition and bamboo shoot productivity were directly connected with their economic interests and relationships with the lived experiences. Farmers' lived experiences are grounded in their economic concerns of bamboo shoot cultivation.

Second, this integrative approach considers how the role of a strong state pursues the governance of sustainable development through top-down axis co-ordination from the State Forestry Administration (SFA) down to County level state and Forestry Bureau. The Lin'an state collaborates with non-state actors within a both state-centric and multi-nuclei governing structure to implement governing concepts, legal instrument, manage institutions and execute policies to achieve the sustainability of bamboo shoot production.

Third, this integrative approach helps this research to reflect on how the role of technology transforms the socio-economic and environmental aspects of bamboo shoot production in Lin'an County. This research looks at the co-constitutive potential of both human and technology as equally important actors

to shape human-nature relationships. This perspective helps this research go beyond the anthropocentric connotations of whether technology is constructive or destructive, and similar dualistic understandings. Additionally, this perspective embraces the vibrancy of technological innovation as a subject to co-produce a series of socio-ecological changes.

To answer the second research question, this research critically examines how governing concept, legal instrument and forestry policies cascade from Central State down to Lin'an County; this research argues that the Central State perpetuates one party rule and state interference in economic reform, which has emerged as a co-existence of state-centric and multi-nuclei forms of governance (see Chapter Five). These multi-nuclei forms of governance means the local state collaborates with research institutions, farmers' co-operatives, bamboo shoot processors' association and bamboo shoot market to influence farmers to grow bamboo shoots in order to tackle both socio-economic and environmental problems in the market reform period. This state-centric and multi-nuclei form of governance has two major features: first, the Central State maintains nation-wide economic planning and top-down co-ordination from the central to county and township level government. Second, the Central State decentralises fiscal autonomy to lower levels of government and de-collectivise communal resources through the implementation of the Household Responsibility System. From empirical analysis of the interactions between state and non-state actors, the Lin'an state is still prioritising economic sustainability before environment conservation though the local state shows the tendency of institutionalisation of environmental practices, regulating illegal logging, systemising bamboo shoot resource management.

The Lin'an state promotes the pro-growth mentality and co-ordinate bamboo shoot farmers to depend on bamboo shoot cultivation to afforest barren hills and increase material well being, particularly after the introduction of the early shooting technology in 1991 (see Chapter Six). Since then, more bamboo shoots

output was required to generate higher income for farmers to obtain additional material well-being. As a result, the intensity of bamboo shoot production needed to be increased; this resulted in greater inputs of fertilisers to replenish the depleted soil and pesticides to stabilize the ecosystem. However, with applying a large amount of fertilisers; these caused the over-production of bamboo shoots and soil degradation problems in Lin'an County.

To tackle the soil degradation, the Lin'an state co-ordinates with research institutions, farmers' co-operatives, demonstration households, and bamboo shoot farmers to strike a balance between (1) the profitability of using the early shooting technology and (2) the promoting of cleaner way of production (see Chapter Six). The former is achieved through the Forestry Bureau's technological extension and the latter is managed through research institutions' and farmers' co-operatives' technological support and organic fertilisers provision. This research found that the local state can extend its authority to influence farmers' behaviours to adopt hazard free production standards and soil restoration techniques through the co-operative and demonstration households' networks. However, it is only confined to a small group of farmers. To a large extent there are still a large group of bamboo shoot farmers, which may not be able to receive proper training to restore their soil and comply with the production standards. Furthermore, the informality and implementation deficit of government policy has caused the soil restoration programme to be sluggish, hindering countywide modernisation of the bamboo shoot production and re-orientation of farmers' unsustainable practices.

To solve the overproduction problem of bamboo shoots, the Lin'an state collaborates with the demonstration household, processing industry and marketing sector to absorb over-produced bamboo shoots, increase production standards and maintain the sustainability of the bamboo shoot industry through land re-collectivisation (see Chapter Seven). The Lin'an state used policy and price instrument to integrate production, processing and marketing sectors of the

bamboo shoot production industry, to re-collectivise the fragmented land resources through land transfer, fix the overproduction problem and institutionalise processing standards to help processors to comply with both production and processing standards. Through studying the empirical data, this research found that land re-collectivisation is full of challenges because of divided and protective mind-sets of bamboo shoot farmers. Although the Lin'an state tried to increase the industry integration, it cannot absorb the oversupply of natural shooting *Ph. Praecox* shoots because of three major reasons: (1) the limits of processing capacity, (2) price gap between early and natural shooting of bamboo shoots, and (3) the pro-growth mentality dominating the processing industry cannot absorb those bamboo shoots.

To answer the third research question, this research examines how the institutional transition, decentralisation process, state and non-state's interactions lead to different forms of governance from the communal period to post market reform to grapple with poverty, low household incomes, environmental degradation, and the integration of industry sectors. Local governance is a form of governing practice below county-level state in the Chinese administration system. This form of governing practice characterises both the collaboration between the state and non-state actors to build development consensus in bamboo resource extraction, establish production and processing standards and utilise labour and artisan skills of local people to tackle both soil degradation and create economic value.

Through contextualising how the local state delivers governing goals and tactics, implements policies and programmes, this research argues that there are five major characteristics of the local state: first, the local state plays a strong role to produce a conducive environment for local leaders, processors, market traders, and bamboo shoot producers to tap bamboo shoot resources, re-organise land and implement forest laws to capitalise the bamboo shoot production industry; second, the arm of state is extended both directly and

indirectly through forest law implementation, knowledge production, technological extension, institutions' establishment, and standardisation of production and processing procedures; Third, the local state in Lin'an is facing the contradictory relationship between developing and sustaining (Tilt, 2010, p.145), manifest as a struggle between "intensification of the extraction and use of natural resources" and environmental conservation. On the one hand, the local state shows a tendency to modernize the land tenure arrangement through forestlands' marketisation and classification, and institutionalise bamboo shoot production and processing standards. On the other hand, the governing capacity of the local state faces the challenges of implementation deficits, informalities, and soil degradation, which hinder the effectiveness of the bamboo shoot production sector to achieve sustainable development. Fourth, there are three major forms of the governance of sustainable development in Lin'an County.

8.3 Three major forms of governance of sustainable development

The first form of local governance of sustainable development in the bamboo shoot production industry is: (1) the "communal form of governance" characterised in developing the wood and bamboo shoot resources to support the socialist industrialisation and political campaigns. Through the collectivisation of land and means of production; the identity of "communal farmer" is constructed to implement Central State's deforestation and afforestation programmes (see Table 24); (2) the second form of governance characterised in "economising ecology", the local state considers developing the bamboo shoot production industry is the priority to grapple with economic needs and restore the barren hills. Through the land de-collectivisation and economic incentive of bamboo shoot cultivation, farmers started planting bamboo shoots on the barren hills. During market reform period, the local state aimed at producing "economic farmers" to utilise bamboo shoot resources to achieve economic and environmental goals.

However, the governing goals of the local state stresses the “developing” of material well-being and economic interest of people rather than “sustaining” the biodiversity and environmental quality of the bamboo shoot ecosystem; (3) the third-form of governance featured in “co-functioning of economy and ecology” through land re-collectivisation, standardisation, and ecological restoration. The local state sees the potential of technological innovations and market forces enable to construct a compatible ecological and socio-economic condition for both “developing” the bamboo shoot industry and “sustaining” the bamboo ecosystem. In so doing, the local state attempted to produce “hazard-free farmers” to comply with hazard-free production standard and restore soil degradation (Table 24).

Table 24 Three Major Forms of Governance of Sustainable Development

Forms of governance of sustainable development	**1958-1978** Communal form of governance	**1979-2000** Economising ecology as a form of governance	**2001-2014** Co-functioning economy and ecology as a form of governance
Development of the Bamboo shoot production sector	Sluggish →	Rapid growing →	Slightly declining
Governing goals	· Collectivisation of forest resources for industrialisation and political campaigns. · Political instability caused deforestation. · Transform farmers into “communal farmers”.	· De-collectivisation to capitalize and individualize the bamboo shoot production. · Growing bamboo become both economic and greening agenda. · Produce economic-man through	· Re-collectivisation through land transfer. · Increase production and processing standards. · Concern the quality of production.

		promoting high value added early shooting technology. • Stabilize the quantity bamboo shoot resources for the processing industry and marketing sector.	• Create “hazard-free” farmers.
Governing tactics	• Organised farmers into People’s Communes; production teams and brigades were established within the Communes. • Shared draft animal manpower, and labour. • Unified production schedules. • Top-down directives and compulsory procurement quota.	• Implemented the Forestland Responsibility system to contract the responsibility forests to individual farmers. • Legal enactment and enforcement (e.g. forest law). • Financial benefits to persuade farmers to grow bamboo shoot. • Employ demonstration household and technological extension service to promote bamboo shoot cultivation. • Imbue the concepts of relatively wealthy society in bamboo shoot production industry. • Transform farmers from communal practices to market-oriented through building “economic farmers” identities.	• Extended the forestland contracts to more than 50 years. • Develop a conducive environment to promote bamboo shoot processing and marketing. • Development cleaner production. • Adopt the farmers’ co-operative and processors’ networks to help farmers to comply with hazard-free production standards. • Imbue hazard-free and sustainable practice concepts through trainings, demonstration

			household network, and processors' requirements. · Introduce organic fertiliser and proper way of pest and diseases control. · Produce the identity of "hazard-free" farmers.
Human-nature relationship	· Strong Anthropocentric	· Still anthropocentric because of manipulation of the seasonality and shooting performance of bamboo shoot. · Property rights increase farmers' incentive and responsibility to protect forests.	· Still anthropocentric but sympathetic to soil degradation · Extending the land contracting period increase farmers' incentive to protect forests.
Steering approach	· Top-down hierarchical policy implementation. · Command and control. · The production team and brigade leaders made the farming decision.	· State-led and multi-nuclei governing approaches. · Decentralised decision-making. · Farmers made their own production decisions. · Implementation deficit · Informality creates policy distortion and failure.	· State-led and multi-nuclei governing approaches. · Using farmers' co-operatives to re-collectivise farmers. · Extend the rule of state to control the production and processing standards of producers and processors

		• County-wide policy may fit well with the local condition. • State-led development model may consider the local state and leaders' interests, the interests of local farmers may be ignore	• To coordinate cleaner production and hazard-free production standard • To utilize the social capital to increase the governing capacity • To create new governing institutions to rationalise natural resource management
Policy-delivery and implementation	• State-centric command and control. • The state collectivised natural and human resources for allocation and procurement.	• Co-existences between state-centric and multi-nuclei governance. • Prioritizing economic development before environmental conservation. • Regulating illegal logging and systemizing bamboo shoot resource management.	• Co-existences between state-centric and multi-nuclei governance. • To re-collectivise land resources to solve the land fragmentation problem.

8.3.1 Communal form of governance

In the pre-reform period, the development of the bamboo shoot production sector is sluggish between 1958 and 1978 when comparing to the market reform period. On the one hand, the management of bamboo resources' allocations were under the Central State's unified procurement and marketing. On the other hand, political campaigns include Three Red Banners and the Cultural Revolution caused environmental destruction, which upset the productivity of agro-forestry sector. The Central State established people's communes to transform farmers into communal workers and adopted household registration system (*Hukou* system) to control farmers to live in the countryside. Through command and control along the administration hierarchy, the Central State delivered the compulsory procurement quota to people's communes to produce cheap bamboo timber for urban industrialisation and bamboo shoots for urban dwellers (see Chapter Four).

8.3.2 Economizing ecology as a form of governance

Since 1978 China has transformed itself from a planned to a market economy, which has been accompanied by the shift from state-centric government to the co-existence of a hierarchical and multi-nuclei form of governance (see Chapters Four and Five). The local state in Lin'an County has increased the collaboration and partnership with non-state actors in managing the bamboo shoot resources. The multi-nuclei form of governance structure allows the local state to maintain intervention, and increase the indirect rule of local state through new institutions establishment (e.g. farmers' co-operatives,

processors' associations, and bamboo shoot trading markets), policies and projects implementation. During the market reform, both the state control and market mechanism were used to manage the bamboo shoot resources. On the one hand, the market reform decentralizes the Central State's policy implementation, fiscal autonomy, responsibilities and decision making for the Lin'an state to decollectivizes land ownerships and means of production from the hands of communes to individual farmers (see Chapter Five). On the other hand, the Central State maintains the state-centric institutional arrangement underpins top-down policy steering; legal regulations, command and control cascade from central to local state to implement the nation-wide Five Year Plan and executes Forest Law. The governance structure of the Lin'an bamboo shoot production industry demonstrates how State Forestry Administration's directives, legal regulations, and commands are delivered to the Lin'an Forestry Bureau to maintain the direct rule of Central State agency. The co-existence of state-centric and multi-nuclei governance structures produce an conducive environment for state and non-state actors to achieve socio-economic and ecological goals through bamboo shoot cultivation.

The implementation of the forestland responsibility system aims at economising the bamboo lands and resources in which de-collectivising forestland and means of production from the hands of rural collectives to individual farmers. The Lin'an state was successful to guide farmers to grow bamboo shoot to afforest the barren hills and implement the household responsibility system to institutionalise forestlands' contracts, classifications, and marketisations to further capitalize household-based farming. In practice, the Lin'an state was successfully to direct farmers to see the economic incentive of bamboo shoot cultivation and reduce their logging incentive. Until the 1990s, the Central State appealed the local state to build a relatively wealthy society in rural Lin'an. The local state responded the Central State's directive by guiding farmers to grow high-economic value *Ph. Praecox* shoots and adopt the early shooting technology (see Chapter Six). Although applying early shooting technology did

help farmers to manipulate the shooting period to meet the market demand and reach the premium market; these causes high inputs of chemical fertilisers, covering materials and pesticides to maintain the stability and high output of the bamboo shoots from the ecosystem. Introducing the early shooting technique in 1991, bamboo shoot farmers can depended on this technology to generate a higher income. The operation of the early shooting technology is highly anthropocentric which involves lots of human manipulation on bamboo shoot plantation. As a result, the intensity of bamboo shoot production needed to be increased; this created in greater inputs of fertilisers to refill the depleted soil and pesticides to stabilise the ecosystem. Finally, this deteriorates the soil degradation problem in Lin'an County.

For the policy delivery and implementation, the Lin'an state employed both policy guidance and economic incentive to attract farmers to grow bamboo shoots to ameliorate soil degradation and generate income on their contracted forestlands. However, both small landholding implies fewer choice in resource use and over prioritisation of growing bamboo shoots in the local development plan have generated two major environmental challenges: first, farmers have over-depended on using fertilisers to boost productivities and transform the seasonality of bamboo shoot to generate a high economic return in a small land plot has caused soil degradation and pollution (See Chapters Four and Five). Second, over-growing bamboo shoot has increased the risk of pests and diseases and farmers' remedial measures are dependent on pesticide usage to fix this problem; however, it increases the risks of biological accumulation of chemical pollutants in the bamboo shoot food chain.

8.3.3 Co-functioning the economy and ecology as a form of governance

Around the 2000s, the Lin'an state collaborates with research institutions, farmers' co-operatives, and demonstration households to influence farmers to

adopt hazard-free production standards and soil cleaning technology to achieve the sustainable development in the bamboo shoot production industry (see Chapter Seven). The Lin'an state sees the potential of technological innovations and market forces can produce a co-functioning capacity between economic development and environmental conservation.

The local state extends its authority to influence farmers' behaviours to adopt the hazard free production standard and soil restoration techniques through the co-operative and demonstration households' networks. Although the arm of state extended in multi-nuclei forms to control the standards of the bamboo shoot production, the changes of bamboo shoot practices does not means that the local state and bamboo shoot farmers prioritized environmental rationality before economic development. Economic rationality is still core value for the Lin'an state and non-state actors. Additionally, the Lin'an state tried to increase the industry integration, it cannot absorb the oversupply bamboo shoots. This is difficult for the local state to strike a balance between the "developing" of the industry and "sustaining" the environmental quality of the bamboo shoot production. By evaluating the governing objectives and implementation of land re-collectivisation, standardisation of processing industry, and non-state's actors interactions in the bamboo shoot market segment, this research argues that the local state tries to utilize more bamboo shoot resources to increase the economic value creation in the bamboo shoot processing and marketing sectors which rather than just absorbing the over-produced bamboo shoots. This model of sustainability in Lin'an bamboo shoot production industry still stresses the pro-growth mentality and material needs of local people by increasing the capacity of bamboo shoot cultivation.

The governance of sustainable development in Lin'an County reflects a problem-solution pattern. In the early 1980s, the local state encouraged farmers to adopt the early shooting technology to overcome the environmental limits of small-landholding problem and boost the productivity of bamboo shoots. As a

result, uncontrollable using of fertilisers have caused the soil degradation problem and hindered the sustainable development of the bamboo shoot production industry. Until 2015, the local state is still struggling to balance between economic development and environmental conservation. In the following section, this research explores the potential of strong state and technological innovations to suggest plausible solutions and policy recommendations to help the local state to tackle the sustainability problem in the bamboo shoot production industry.

8.4 Policy Recommendations

There are two major potentials of a strong local state which can increase the sustainable practices in the bamboo shoot production sector: first, the local state can help pro-active farmers to contract lands from part-time farmers and farmers who abandon their lands by establishing an updated land transfer database for pro-active farmers to contract those available lands in different villages in Lin'an (see Chapter Five). Additionally, the local state can provide more financial subsidies and social security for farmers who abandon their lands to increase their incentive to contract their lands to pro-active farmers and private enterprises.

Second, the local state can enhance the intelligence system and technology production by utilizing the high calibre personnel from the Zhejiang Agricultural and Forestry University (ZAFU) and Zhejiang University to manage the degraded lands and develop a soil quality monitoring system. This research realizes the potential that technology can bring toward cleaner production for the Lin'an bamboo shoot production sector. The debates on the role of technology should not be drawn into whether it is "good or bad" direction. Instead, we should probe deeper by thinking about whether the creations of technology will or will not sustain the modernity of the human and non-human nature.

To further manage the degraded lands and sustain the bamboo shoot production sector, bamboo shoot cultivation expert Dr. Chen at the China Forestry Research Institute of Subtropical Forestry (CFRISF) suggested five major technological fixes which can be applied to the bamboo shoot plantation: (1) manage the structure of the bamboo forest by reducing its intensity and nurturing more mother stalks; (2) replace chemical fertilisers with organic fertilisers with the high content of amino acid and humus; (3) practice crop

rotation and reduce the intensity of applying soil covering materials to let soil fallow; (4) apply deep ploughing after four to six years of applying early shooting technology; and (5) adopt the intercropping technology by growing bamboo shoots along with leguminous plants, watermelons, and potatoes (Interview with bamboo shoot expert E01, 2012) (see Figure 44).

Figure 44 The Application of the Intercropping between Bamboo Shoots and Beans (Source: Courtesy to Dr. Chen H.L. in 2012)

Concerning the establishment of the soil monitoring system, the Lin'an state can collaborate with the Lin'an Forestry Bureau, Zhejiang Agricultural and Forestry University (ZAFU), and Zhejiang University to educate farmers about the crucial role soil plays in food security and provides essential ecological services, takes action for the sustainable management and protection of soil resource, promote investment in sustainable soil management and promotes the agro-forestry practices (United Nations International Year of Soils, 2015). More

importantly, the Lin'an state can systemise the soil information collection capacity by installing a soil testing electronic device in each bamboo shoot cultivation village in Lin'an County to monitor the quality of the soil. On the one hand, this device provides a series of rapid, accurate, and standardised soil monitoring procedures to test the chemical accumulation of calcium, sulphate, chloride, and cadmium, lead and copper in bamboo shoot farmers' soil (see Figure 45). On the other hand, the local state can monitor the soil quality and provide instant assistance to help farmers to comply with production standards.

Figure 45 Soil Testing Device, for example Electronic Soil Lab, Model DC-12 as shown (Source: Thomas Scientific, 2015)

With the strong role of local state to take effective measures of better forestry training and provide soil-monitoring technology, these can strengthen the sustainable management and protection of land resources in Lin'an County. More importantly, providing proper training and equipping the next generation with sustainable forest practices are crucial steps to promote hazard-free production, protect healthy soil, and encourage this group of energetic educated farmers to contract other farmers' lands. For instance, the Zhejiang Agricultural and Forestry University (ZAFU) provided seven major areas of undergraduate programmes including silviculture, forest conservation, biotechnology on bamboo genetics, ecological engineering, microbiology, biology, and Chinese medicine to train 1,000 students annually. The ZAFU developed a learning and research platform to equip students with modern silviculture practices and sustainable forestry knowledge (see Figure 46).

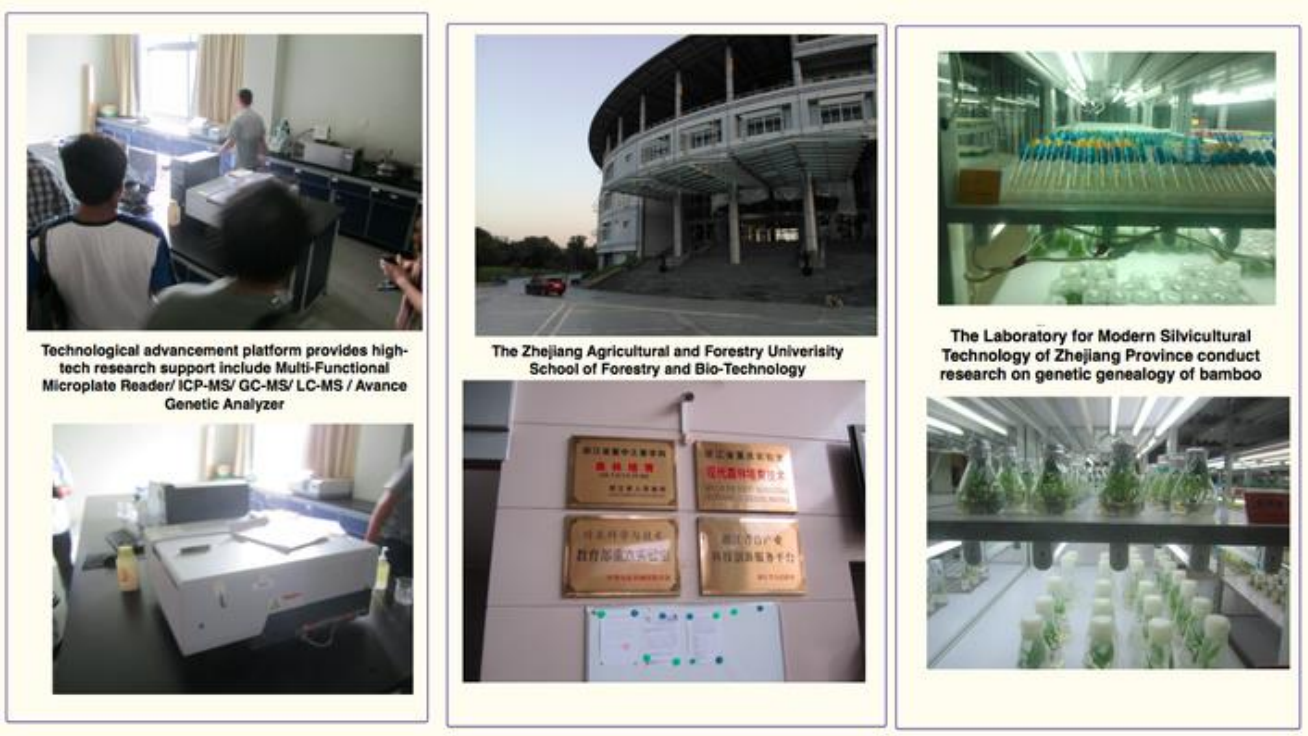

Figure 46 The Knowledge Production Sustainable Forestry Practices (Source: Author's Collection)

This group of young educated students are more open to adopt new technology and absorb environmental knowledge to apply in the bamboo shoot production sector if they become bamboo shoot farmers. An interview with a 27 years old Hangzhou Li Weng bamboo shoot co-operative director Mr. Yu,

> After my undergraduate study, I came back to Li Weng to help my old father to establish a bamboo shoot co-operative. Now, our co-operative has 160 members and all members comply with hazard-free production standards. To do this, we provide standardised trainings, produced our own organic fertilisers, and conducted our own bamboo shoot research on improving the performance of early shooting. Our members could enjoy half price discount to purchase our co-operative's organic fertilisers (Interview with co-operative director C03, 2012).

From Mr. Yu's comment, we can identify the potential of young educated farmers to make a change on the production system by helping the co-operative members to comply with hazard-free production standards and adopt a cleaner way of production. This research tends to prove that the potentials of young educated farmers are full of vitality, entrepreneurship, openness to adopt a cleaner technology, and promote investment in sustainable soil management activities to maintain cleaner soil for bamboo shoot production.

8.5 Conclusion

Bamboo production have presented a shift of food values, rural-urban linkages and human-nature relations under China's modernisation. This research adopted an integrative approach to combine the theoretical insights of ecological modernisation, eco-Marxism and political ecology to contextualise the local governance of sustainable development in the bamboo shoot production industry. Not only does the research fills the gap in the debates between advocates of political ecology, ecological modernisation and eco-Marxism by formulating an integrative framework to theorize how the local state makes use of bamboo shoot resources to grapple with socio-economic needs, overcome environmental challenges and it also helps this research to identity the potential, processes and consequences of bamboo nature to ameliorate environmental decline. The lessons of using bamboo to fix environmental problems in China can be further achieved through the role of strong state, the innovation of soil restoration technology, and utilization of a pool of young educated farmers.

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APPENDICES

Appendix 1

Cardiff School of City and Regional Planning
Head of School Professor Chris Webster BSc MSc DipTP PhD DSc(Econ) FRSA
Ysgol Cynllunio Dinesig a Rhanbarthol Caerdydd
Pennaeth yr Ysgol yr Athro Chris Webster BSc MSc DipTP PhD DSc(Econ) FRSA

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15th June 2012

TO WHO IT MAY CONCERN:

Dear Sir or Madam:

This letter is in support of the research of my advisee, Mr. Kin-Wing (Ray) Chan. He is a PhD researcher receiving a three year President's Research Scholarship in this school. This scholarship is a flagship award which carries the prestige of association with the University's new President. Mr. Chan entered our doctoral program after two years Master trainings at the University of Calgary, Canada and two years as a researcher at Hong Kong Polytechnic University. Ray has strong aspirations to conduct original research and faculty support for his doctoral dissertation research on negotiation and trust formation in cross-cultural strategic alliances. He has done preliminary interviewing and literature review. His plan for conducting field study has been approved by his committee of three professors.

Mr. Chan would like to interview you in connection with his research. He is also particularly in need of referrals to Chinese experts he can interview for the purpose of understanding their perceptions of government-driven ecological policies to develop eco-economy, transform producers' behaviors on resource management, and increase the sustainability in the bamboo industry. Hitherto, no single study has studied the perspectives of Chinese experts before on this subject. However, Mr. Chan finds it very important to understand the perceptions of experts contribute to the sustainability of the bamboo industry in China.

The interviews will be absolutely confidential. No personal identifying information will be collected, and all interviewed shall remain anonymous. All information provided will be used in Mr. Chan's dissertation only; it will not be shared with any third party or other organizations. I will very much appreciate any assistance that you can provide him in the research process.

Mr. Chan will be happy to discuss his research findings with you and with those he interviews after the research is completed. If you have further questions regarding his research, please do not hesitate to contact me.

Thank you in advance for any assistance you can render Mr. Chan.

Sincerely yours,

Dr. Andrew C. Flynn

Director, Master Program
Reader, City and Regional Planning

Email: FlynnAC@Cardiff.ac.uk
Telephone: +44 (0)29 208 74851

Appendix 2

Cardiff School of City and Regional Planning
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可持续发展之反思：探討生态现代化政策对中国浙江省临安種竹业之影响

陳建榮

英国卡迪夫城市与区域规划学院

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於浙江省臨安，竹子生产從伐林到护林展現了中国现代化的過程中生產者与大自然关系之转变。臨安市政府和農民嘗試吸取七十代伐林所造成的教訓，明白到胡亂伐林只會加深生態和經濟破壞。於八十年代改革初期政府鋭意發展種竹工業來解決水土流失和農村貧窮問題。由此，政府實施包產到戶、竹林管理、財務支持等政策，再配合新科技與知識生產推動了臨安的生态现代化。所言之，生态现代化是指生產規模增加的同時亦能兼容環境保護。研究者於 2011 秋天作实地考察，了解到臨安政府倡导生态现代化的政策，支持種竹的生产和加工网络的拓展。这些政策包括三个主要领域：改善生产和加工技术、加强业务的网络、提供資助和奖励。从产品的可持续发展的角度来看，乡镇政府於加工過程中回收竹碎片和縮短竹生产供应链中起着积极的作用。然而，對於生态现代化的過程中对环境和社会领域的評估和影响則較缺乏。本研究采用混合方法，如田野考察、深入访谈、个案研究，来了解 1978 年後政府林业政策如何帶动竹子产业的生态转型和可持续发展。在何种程度上可以说明林业政策促进

1

政府机构，竹子生产厂和加工厂，以及农村社会实施关注生态的做法？本研究以深入和认真的治學態度來分析種竹业的生态现代化中的機遇和挑战。

究竟浙江省林业部 、臨安的乡镇政府如何透過生態現代化來建立竹的生产和加工网络來提高经济和环境的可持续性？本研究的主要目标有三个：（1）了解臨安的乡镇政府如何落实生态现代化的政策（即创新的技术和知识）來增提高竹子的生产能力（2）评估生态现代化的技术对环境和社会领域的的影响（3）了解不同的持份者如何理解種竹工业的生态現代化进程例如竹资源管理和竹林环境治理。

甲、前言

在过去的 30 年，中国经济已进入高速發展的阶段，但急速的经济发展卻造成高昂的环境成本。中国共产党党主席胡锦涛呼吁党员，實踐"科学发展观"，强调"可持续发展"和"平衡"的资源分配等概念（新华社，2007 年）。知识分子、传媒、 环保专家和非政府组织敦促中国采取审议的態度去處理环境问题。自 2007 年以來，生态现代化已经成为中国一个新的环境议程，因为生态现代化理論所提倡的发展前景能協助中国經濟和環境发展達至一个双赢的局面，在保持经济增长的同時能減少对环境的影響。本研究認為臨安的生態現代化可以追溯到 1983 年中國改革之初。在此期间，中国正重整农村土地制度，農村家庭实施联产承包责任制。特别是竹林生產的土地改革。臨安的农村集体承包制為個體戶賦予農民十年至三十年的土地使用权和個人收入权利，这标志着私有化，市场化，提高竹产业的生产力。此外，臨安市林业局倡导的优惠政策，包括补贴的規定，研究和开发，竹子种植培训，和创新的知识和技术应用。隨着乡镇级政府的援助，竹子种植知识和技术得以推扩至竹生产者、民营企业、研究机构，这些持份者群策群力，以推动臨安經濟发展和環境保護達至一个双赢的局面。

乙、浙江省临安種竹业的生态現代化情况

中国科科学院主張以生态现代化為綱領以此帮助中国达到經濟和環境发展達至一个双赢局面。因為生态现代化的概念 一方面能減少环境退化、減轻社会冲突、资源的管理不善。另方面，它符合中国的持續发展愿望。細看浙江省临安與安吉種竹业，研究者認為種竹业具有實踐生态现代化的潜力。

丙、研究问题和方法

1. 了解 1978 年後政府林业政策如何带动竹子产业的生态转型和可持续发展。
2. 在何种程度上可以说明林业政策促进政府机构，竹子生产厂和加工厂，以及农村社会实施关注生态的做法？
3. 了解不同專家對中国竹产业的生态转型之看法和意見。

研究方法

1. 深入访问
2. 田野考察
3. 资料搜集
4. 个案研究

丁、研究价值

竹子具有優厚的生態、經濟、社會發展潛能:

竹子能以每天 1.2 毫米的增长速度的植物，它一方面能加快再造林(reforestation)的植被，另方面，它能提供可再生的经济作物：

生態潛能方面

竹子比一般植物二氧化碳吸收率快兩倍以上。竹子具高環境适应性，能種於退化土地和陡峭的山坡上種植。故此，它能延緩土壤侵蚀和水土流失。竹子是绿色建材，它不但能取替伐木(lumbering)，而且它能改善全球变暖的影响。

經濟潛能方面

竹子是多用途、高回报的经济作物。竹子可加工成五千多樣產品，如竹家私，竹炭，竹製啤酒，竹製服装，竹地板等。於 2005 年，<u>隆安</u>的竹笋生产总值達到 560 萬人民幣相比於 1983 年（219 萬人民幣）增加了 256 倍。

社會發展潛能方面

於中國文化历史中竹子具有深遠悠久的文化象徵，自古文史詩哲皆喜以竹子喻表具氣節的君子，如苏轼和郑板桥於其詩賦字畫中表達中國人的人文價值，道德情感投射於竹子上。 由此，竹子可讓當代中國人反思人與大自然的關系中國文化與現代化的柔合。

反思竹子於社会领域的應用能給合中國農村社會的情況來制訂经济效益的發展藍圖，如浙江溫洲發展模式利用政治經濟的体制能力（institutional capacity），以政府和市場互動來推動經濟發展和解决环境问题。地區政府正投放資源调和二元社会、經濟發展與保護自然之间的矛盾。

種竹工业发展的同時兼容环境保护

於種植過程中，政府推動種竹的新知識如 （1） 竹笋高产種植法（2） 竹笋細胞组织培养技术。政府亦倡导新種植技術之應用，如 （1） 经济林之管理 （2）害虫和疾病之管理。

於加工過程中，政府應用創新的加工知識如 （1）开发研究竹材料的應用 （2）加工時強調資源回收、再利用、和減少废料 recycle, reuse, and reduce（3）清洁生產知識 knowledge of cleaner production（4） 绿色价值链之應用 green value-chain。於創新加工技術方面（1） 竹板粘贴合成技术（2）竹板层压技术， 能做到近乎百份之百竹废料的回收和再利用，达至清洁生產的條件。

戊. 訪問目標和方向

1. 搜集到不同專家對中国竹产业的生态转型之看法和意見。
2. 搜集到與臨安竹子生产工业的辅助数据、行业情况和相關資料。
3. 實地考察臨安竹子生产和加工廠和不同持份者訪談。

Appendix 3

Gmail by Google

Kin Wing Chan <kc135704@gmail.com>

Fwd: 答复: 到访国际竹藤组织和研究合作事宜 (Visiting acceptance letter from INBAR)

Chan Kin Wing (Ray) <kc135704@gmail.com> 2012年6月29日 下午2:42
收件者: Andrew Flynn <FlynnAC@cardiff.ac.uk>, Li Yu <YuL@cardiff.ac.uk>

Dear Dr. Flynn and Dr. Yu,

I am grateful to hear that Prof Zhu Zhao Hua would like to provide help on my research on bamboo production in Lin'an. Here I would like to forward his letter for your record.

Currently, I am trying to approach some universities and government officials in Zhejiang, Shanghai, and Beijing. I found it quite challenging. This will be very helpful if you can offer guidances and helps on making connections with local universities, research insititutes, and government organizations. I sincerely hope I can utilize my time and resources when I conduct field study in China. I hope this research can be beneficial to China's rural development and flourish the humanity.

Should you have any problems, please do not hesitate to contact me.

With best wishes,
Ray

---------- Forwarded message ----------
From: **Zhu ZhaoHua** <zhzhu@inbar.int>
Date: 2012/6/29
Subject: 答复: 到访国际竹藤组织和研究合作事宜
To: "Chan Kin Wing (Ray)" <kc135704@gmail.com>

建荣博士，

您好!

我很难高兴收到您6月28日的来信。有关您8月中旬-9月中旬到INBAR进行实习和交流，我们表示热烈欢迎。在您来之前，需要我们做什么准备，请您告诉我。如果需要的话， 我们可以为您准备一个日程，帮助您达到来信中所提到的研究目的。

关于您的研究内容，我建议不要仅限于竹产业，是否可以拓展到非木质林产品（NTFPs），但重点可以放在竹产业上。通过一系列生态现代化政策，促进NTFPs产业发展，从而促进乡村社区可持续发展，进而促进森林可持续经营，达到临安可持续生态系统的建设和完善。我希望通过您的论文，能够使2010年"山区综合可持续发展研讨会"上所发表的"临安宣言"所提出的"临安模式"有更丰富的内涵，在国际上有更大的影响。至少为发展中国家提供一个在一个地区如何逐步实现可持续发展的范例，所以我们对您的研究项目有更高的期待。我和金蕨可为您听过您所需要的支持。

今年9月2日至9月10日，我们将在临安召开"竹产业可持续发展国际研讨会"，所以我建议您在中国期间参加这个研讨会，会议期间还将参观安吉的竹产业。

附件是我给Andrew C. Flynn博士的回信。

竺肇华
Zhu Zhaohua
Distinguishd fellow of INBAR for life

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In partnership for a better world

发件人: Chan Kin Wing (Ray) [kc135704@gmail.com]
发送时间: 2012年6月28日 0:54
收件人: Zhu ZhaoHua; Jin Wei
主题: 到访国际竹藤组织和研究合作事宜

國際竹藤組織總部
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望京阜通东大街8号
原副总干事
國際竹藤組織终身成员

亲爱的竺教授、金薇女士，

到访国际竹藤组织和研究合作事宜

您好！很感谢你于工作坊的教导和鼓励。回英国以后，学生于建议书中撰述临安种竹业具有实践可持续发展的潜力。研究院院长特里·马斯登（Prof. Terry Marsden），系教授安德鲁·弗林博士（Dr. Andrew Flynn）与俞立博士（Dr. Yu Li）了解过临安的具体情况后，皆顶力支持学生研究临安种竹业如何推动中国生态现代化和可持续发展提供创见。大学对这研究甚为重视并提供奖学金以此鼓励学生作实地考察和深入访问，务求以更多角度去了解临安种竹业的经验。于去年与竺教授谈及到访国际竹藤组织和研究合作的机会，学生希望透过此信阐述到访的因由。

Appendix 4

尊敬的唐局长,

临安竹笋產業模式的調查綱領

你好! 临安通过一系列政策，促进竹笋产业发展，从而促进乡村社区可持续发展，进而促进森林可持续经营，达到临安可持续生态系统的建设和完善。学生希望透過這篇博士论文，能够達到以下目標：

（1） 使 2010 年“山区综合可持续发展研讨会”上所发表的“临安宣言”所提出的“临安模式”有更丰富的内涵。致力為推廣临安模式於国际上社會上的影响力，繼而為发展中国家提供一个在一个地区如何逐步实现可持续发展的范例。

（2）對不同層面的林業政策進行分析，從而竹了解临安竹笋產業的可持續發展因素：

- 从毁林到退耕还林，由伐天然林转变至伐人工林
- 从政府主导林业发展扩至多方参与 - 政府+生产基地+企业生產模式
- 从割裂的生态观到整体林业发展规划
- 从无偿使用到有偿使用
- 从贫穷走到小康

在上述意义來说，临安竹笋產業的可持續發展是经由政府、企業和民众共同透過实际做法來实现。因此，本研究区分竹笋业中的三大网络 – (1) 政策网络， (2) 经济网络和 (3) 社会网络作為分析框架。

对于竹子的**政策网络**，研究的重点集中於政府和整個竹笋业之間關注生态經濟的政策互動，研究集中四个主题上：

一. 勾勒临安**重要的林业政策**如何帶動竹笋产业可持續發展

- 臨安模式：
  过去五届政府皆大力支持竹笋一产，二产，三产的发展，提供资助和税务优惠;并且建立示范户，示范村。此外，技术人员的推广新的種植知识和生產科技、建立多方参与生產模式 (政府+生产基地+企业) 、 參考國內外的林業管理模式。特別是地方政府的參與和技術人員的貢獻皆為臨安竹笋產業建立基礎。

一. 了解政府部門於竹笋产業中，一产、二产、三产的**管治**

二. 政府部門和農民如何**吸取**過往破壞森林的教訓和**学习**保護森林的做法。

三. **農戶和企業**如何**回應**政府的政策，建立生態經濟、經濟生態的方向。

对于竹子的**经济网络**，研究重点集中於竹子企业間於生产过程中如何促进生態經濟的發展，由此研究集中四个主题上：

一. 了解竹笋加工企業自身、企業之間、和企業與農戶如何帶動生態經濟、竹废料回收和可持續發展生產。究竟竹子的经济网络如何於**供應鏈**中創造和提高**生态**和經濟**价值**？

a. 毛竹笋和毛竹干粗加工的資源回收
b. 雷竹笋
c. 高節竹笋

二. 了解竹笋行業的發展的成功因素

三. 了解研究机构、大學、竹生产者、加工者、專家**如何分享他们的知识和技术**，促进企业間於生产过程中關注生態經濟的做法。

a. 了解研究机构、大學如何促进竹笋生態經濟的科研項目
   i. 早出技術
   ii. 測土施肥技術
   iii. 無公害、綠色生產和有機生產技術
   iv. 示範林，可持續發展示範林

四. 有何**因素**促使竹笋经济网络中採取關注生態經濟的做法。

a. 經濟利潤引導 - 竹子的特性（可造成多樣產品， 種植時間短）和技術改良（竹廢料可重新使用）以致改伐竹子人工林

b. 多样化的收入来源，不單靠伐木而靠竹子為基礎的非木質林產品

1. 個案研究
   a) 青云村 和高云村 - 太湖源鎮－雷竹
      i. 與示範戶作訪談
      ii. 企业生產模式
      iii. 了解供應鏈中創造和提高生态和經濟价值

   b) 東坎村和白沙村 - 太湖源鎮
      i. 了解非木質森林產品對生態多樣化的影響
      ii. 了解從伐林到護林的過程 – 生態遊
      iii. 了解生態補偿基制
   c) 板橋鎮
      i. 毛竹基地

ii. 毛竹粗加工
iii. 毛竹精加工
iv. 到訪加工廠了解竹材浪費到資源回收和收集數據
v. 竹制品消耗原材料調查表

資料搜集:

政策文件

1. 第二轮土地承包制的政策
2. 集体林权制度改革的政策
3. 竹林生產经营扶持政策
4. 竹子經销、加工和运输管理政策
5. 发展竹笋专业合作社的政策
6. 种非木質林产品政策
7. 树立示范户政策
8. 政府财政补贴政策
9. 促進农户参与竹产业的政策
10. 临安市千里富民林道建设总体规划

相关數據搜集 (请見附件)

臨安食用筍項目基本情況 1983- 2012 數據
臨安市菜竹加工生產情況 1983- 2012 數據
臨安市竹荀業加工企業協會 - 成立以來分年度加工情況數據
优化林种结构數據
個案研究數據(青云村、高云村、東坎村、白沙村)

建榮敬上

校長獎學金博士生

英国卡迪夫城市与区域规划学院

附件

(1)教授推薦信

二零一二年十月十五日

Appendix 5

CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD	**Cardiff School of Planning and Geography,** **Cardiff University, Wales, UK** **Lin'an Bamboo Shoot Farmers Survey**

Purpose of the study

The purpose of this study is to examine how government policies affect the bamboo shoot production industry and farmers' practices in Lin'an County. This survey is divided into six sections and the questions are to understand your perceptions on your livelihood and how state policies influence your daily practices.

Name: _____ Phone no:
Where do you live?
What is the geographical landscape of your village?
①Flatlands ②Undulating slopes ③Mountain area ④Others landscape

Questions

A. Bamboo shoot farmers' conditions

(if not referenced, please put a "√" on the option)

1. How old are you?: ____ Gender: M F

2. What is your education level: ①Below Primary ② Primary ③ Junior high ④Senior high school ⑤ Above high school

3. What is your major job? ①Full-time farmer ② part-time farmer ③Mainly non-farming work

4. Do you have any working experiences apart from farming? Yes no

5. Have you owned any business? Yes no

6. Have you employed as a worker? Yes no

7. Are you a member of the Chinese Communist party? Yes no

8. How many family members do you have: ___ people, working population (16 – 60 years old) : _____ people; and how many of them are engaging in bamboo shoot cultivation?

9. How large is your forestland which your family is operating: ____mu
Have you contracted other forestland from someone else? If yes: ____mu

10. What is your family's total income (in 2012) : ____ Renmenbi
About what percentage of your total family incomes comes from bamboo shoot _____(%)

11. What is your family's income level when comparing to other farmers' households?
① Very low ② Low ③High ④Very high

12. What proportion do your family's income from bamboo shoots____(%)

13. What is the size of your family's bamboo plantation when comparing to other farmers' households? (choose one only)
①Very small ②Small ③Medium ④Large ⑤Very large

14. How long have your been engaging in bamboo shoots cultivation? _____ years

15. What is the main reason for your family to grow bamboo shoots? (choose one only)
①To earn a living ②To be rich
③To have a sustainable income ④No other choices

16. From where does your family learn the skills of planting bamboo shoots? (Can choose more than one)
①Learn from scratch ②Learn from the demonstration households
③Participate relevant training ④Receive guidance from forestry specialists

17. What is the main source of capital you obtained from and invest in bamboo shoot cultivation? (can choose more than one)
①Owned savings ②Borrow from relatives ③Borrow from friends
④Agricultural Credit Unions ⑤Bank loan 6Others

18. How many employees are you employed to cultivate bamboo shoots?

No employees	Employed less than 3 months	Employed 3 to 6 months	Employed over 6 months
Amount of people			

19. Have your family been circulated land from other people for planting bamboo shoots?
①Yes ②No

⟶ If yes,

What kind of land it is? ①Farmland ②Forestland;

How does your family's land contracted from?

①Through the village committee

②Through direct discussions with farmers

③Through introduction from acquaintances

④ Through the local government

⑤Through other ways

20. What are the main problems your family encountered now in planting bamboo shoots? (Please put a "circle" on 1, 2, 3, 4, 5 according to the extent of problems)

Categories of problems	No problem	Little problem	Relatively small problem	Relatively problematic	Very problematic
1.)Land	1	2	3	4	5
2.) Capital	1	2	3	4	5
3.) Labour	1	2	3	4	5
4.) Soil degeneration	1	2	3	4	5
5.) Biodiversity	1	2	3	4	5
6.) Sales	1	2	3	4	5
7.)Quality of fertilisers	1	2	3	4	5

21. Which types of support you want to be obtained from the state? (Choose 3 only)

①Financial ②Technical ③Land contracting ④Marketing ⑤Environmental degradation

22. What is your future plan to grow bamboo shoots? (Choose one only)

①Increase the scale ②Stabilize the current scale ③Reduce the scale ④Abandon the plantation

⟶ If you plan to increase the scale of your bamboo shoot farm, what is the main reason? (Choose one only)

①To increase the profit with the scale ②There is a potential market

Section B the sales and marketing of bamboo shoots

23. What is your total comes from selling bamboo shoots in 2012: ____ renmenbi

24. What proportion of bamboo shoots does your family sell to market: ___(%)

25. Where are you going to sell your bamboo shoots?
①Within the county ②Outside the county but within the province

③Outside the province but within the country ④Outside the country

26. What do you think about the price fluctuation in the local bamboo shoot market? (choose one only)

①Very stable ②Quite stable ③Stable ④Fluctuate ⑤Very fluctuate

27. How far is your home from the fresh bamboo shoot markets? (choose one only)
①0-5 km ②6-10 km ③11-15 km ④15 km above

28. What marketing channel you choose to sell your bamboo shoots? (choose one only)

①Sell by my own ②By intermediaries ③By farmers' cooperatives
④by placing orders ⑤Other

Section C. Farmers' perceptions on farmers' cooperatives

29. Do you know how the bamboo cooperatives work? (Choose one only)
①Never heard of it ②Heard of it but do not understand ③Understand it a little bit
④Partly understand ⑤fully understand

30. Are there any bamboo shoot cooperatives nearby your home?
①Yes ②No

31. Do you think that bamboo shoot farmers who have to establish their own cooperative?
①No need ②Really need to

32. What kind of service cooperatives do your think which is mostly needed for the village?
①Purchasing of agricultural resources ②Funding ③Products selling
④Technical and information providing ⑤ Integrated services 6. Others

33. What kind of problems do you think, farmers will encounter if establish a bamboo cooperative? (Choose 3 in the following options)

① Difficult to unite the will of people ② Poor leadership ③Lack of support from the State ④Farmers don't know how to organise ⑤Others (please explain)

34. Do the local state provide policies to support the development of farmers' cooperatives? (choose one only)

① Don't know ② Yes there is ③No there isn't

Section D. Before and after the implementation of forestland responsibility policy (1978-1998)

35. Before the implementation of forestland responsibility system, how did you perceive forest resources?

①The people's communes own it ②Using forest resources according to state's quota
③ Selling to urban market under market price. ④Using for socialist modernisation and industrialization

36. Before the implementation of forestland responsibility system, why there were illegal logging?

①People were too poor and they could sustain themselves merely through logging
②Ownership hasn't been clarified clearly
③Poor management of the People's Commune
④Lack of knowledge to conserve the forest

37. After the implementation of the forestland responsibility system, are there any conflicts happened in your bamboo shoot forestlands?

①No ②Sometimes ③Always ④Others

38. After the implementation of the forestland responsibility system, are there any conflicts concerns about the boundaries of your bamboo forestland?

①No ②Boundaries are clear but there are arguments sometimes
③Always ④Others

39. How do growing bamboo shoots can reduce logging?

①Bamboo shoots provided income and farmers don't need to go logging
②State's legal enforcement
③Farmers gain knowledge through conserving the forest
④Farmers learned from the disastrous flooding after logging

40. The state government advocated the policy of barren hill elimination in the 1980s, do you think that the state achieved the policy goal to green the mountain and preserve the water resources?

①Yes ②No Why? _____

41. Who are playing the major role to protect and conserve the forests? (Choose one only)

①Government departments and the village committee
②Farmers' Cooperatives
③Forest's Specialists and technology extension officers
④University and scientific research institutions

42. In 1998, the State Forestry Administration implemented the logging ban, what influences did it bring to you?

①Feel economical pressure due to the reduction of income
②Feeling skeptical to the government's policy
③Logging illegally to sustain daily lives
④Switching to grow bamboo shoot
⑤No influence

The extension of the land contracting policy (1999-2029)

43. What do you think about the stability of land contract under the extension of land contracts between 1999 and 2029?

①Always stable and there is not much adjustment for the land boundary
②Relative stable
③Not stable and need to adjust the land boundary

44. Are there any arguments in the 2nd land contracting?
①No ②Some arguments ③Always

Why?_____

Collective forest reform (2009 till now)

45. Have you heard about the collective forest reform since 2009?
①Never heard of it ②Heard of it but don't understand ③Have full knowledge of it

46. How is the collective forest reform is carried out in your village?

①Decide by the village ②Decide by the village group leader committee
③Decide by voting of villagers ④Decide by voting of representatives ⑤others

47. Before the collective forest reform, were there any land conflicts happened in your village?

①No conflicts ②Conflicts were confined to several regions ③Conflicts were common

48. Before the collective forest reform, why there were conflicts between bamboo shoot farmers?

①The boundaries of the forestlands were ambiguous ②Ownership of forest were not clear
③Ideas of collective ownership were not well defined

49. If the collective forest reform allowed farmers to contract the forestland for conservation, would you willing to contract it?

①I am willing ②I am not willing

Why?_____

50. What do you about the extension of land contract can encourage farmers to conserve the forest?

① It increases the scale of production and allow farmers to protect the bamboo land and other forestlands
②It releases labour forces, farmers who contracted their lands to other farmers could go working in the city
③The forest ownership lasts for 50 years, which motivates farmers to protect the forest

51. Does the stability of the forest ownership influences the attitude of farmers to conserve the forest nature?

①Yes ②No

Why?_____

Section E. The influences of bamboo shoot cultivation

52. Will bamboo shoot cultivation reduce the willingness of deforestation?

①Yes ②No
If yes, Why?_____

①Planting bamboo shoots creates good economic values
②The values of farmers have shifted from logging to engaging in bamboo shoot cultivation
③There are specialists who supervise planting of bamboo shoots
④Bamboo shoot income can substitute the income from logging

53. What kinds of support do the government department want to provide? (choose no more than 3)
①Funding support ②Technical support ③Land transfer and contract policies
④Marketing assistance ⑤Basic infrastructure provision

54. Evaluate the factors, which contributes to the success of bamboo shoot cultivation?

	No influence	Very minimal influence	Small influence	Relative influential	Very influential
1).Government's financial support					
2). Support from the processing industries and farmers' cooperatives					
3). Marketing channels organised by the farmers' co-operative					
4). Learning from the demonstration households					
5). Learning from training and seminars					
6). Sound land policy					
7). Subsidies provision					

Section F. The impact of state's financial assistance toward farmers' bamboo shoot practices

55. What are the reasons for bamboo shoot farmers to receive the leading and guidance from the government?

①Lack of knowledge to the understand the market condition
②The government needs to maintain and sets rules for the immature market
③The government provides funding support
④The government act like a middleman to maintain the benefits
⑤The government provides infrastructure
6. Others

56. Have you received the government subsidies?
①Yes ②No

57. Without government's subsidies, are you willing to increase the bamboo forests' biodiversity or preserve the mountain environment (e.g. water source and animal habitats)
①Yes ②No

If yes, Why?_____
If no, Why?_____

①No economic value, so there is no reason to do so
②No demonstrations how to have no knowledge of how to do so
③No knowledge so I don't know how to do so
④Others

58. Have you heard about the concept of sustainable development?
①Yes ②No

If you have heard about it before, how do you define it?
①Economy and ecology can develop together
②Development that meets the needs of the present without compromising the ability of future generations to meet their own needs
③We need to develop the economy first, and then we conserve the ecology latter

59. What are the impacts of apply the early shooting technique?

	No impact	Minimal impact	Some impact	Large impact	Relatively large impacts
①Soil fertility decreased					
②Pests and diseases increased					
③Bamboo shoot forest degraded					
④Forest structure changed					
⑤Biodiversity is affected					

60. If your bamboo shoot forest is degraded, can you describe the condition and extent of the degradation? For instance, How large was the degraded areas? Does it related to inferior fertilisers?

61. What is the main reason to cause the bamboo shoot forest's degradation?
①Overuse of chemical fertilisers
②Lack of organizing experience
③It's against the nature to maximize the production rate
④Overproduction has used up the resources and nutrients in soil

62. How are the following factors influences your attitudes to toward the forestlands and the surrounding environment?

	No influence	Minimal influence	Small influence	Large influence	Very influential
①Conserving the environment allow bamboo forest and other forest species to achieve sustainable development, then it can achieve the win-win situation between development and conservation					
②Bamboo shoots bring economic benefit then it motivates farmers to protect the forest					
③The government enact laws and provide guidance to change farmers thoughts (e.g. by funding and policies)					

④Technology innovation and new knowledge have changed the mind of farmers					
⑤The demonstration household and forest bureau technicians promoted sustainable way of organizing the ecology					

Please explain your choices and why?

_____

G. Evaluate the participation of bamboo shoot **farmers in policy decision making and implementation process**

63. Do you understand the bamboo shoot production policies below?

	Yes	No
①Collective Forest Reform policy		
②Bamboo shoot subsidies provision policy		
③Agricultural products marketing and selling policy		
④Bamboo forest contracting organization forestland land responsibility policy		
⑤Ecological-forest policy		

64. Before the implementation of the above policies above, have you consulted by the forest bureau?
①Yes ②No

If yes, in what way? _____

①Villagers' representative meeting ②All villagers' meeting
③Village's notices ④Discussions with villagers in the village committee
⑤Other methods

65. If you have any conflicts in your forestlands and complains, what is the major channel to express your opinions?

①Lin'an Forestry bureau
②Farmers' cooperatives
③Lin'an County government
④Village committee
⑤Others (e.g. the internet)

End

Appendix 6

受访同意书

研究人员资料:

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首先，卡迪夫城市规划学院研究伦理委员会批准了这一项研究。受访者可保留一份受访同意书，作为非正式同意的受访程序。如阁下对此研究的内容有任何疑问，欢迎向本人提出，请细心阅读以下资料:

研究主题:

探討生态现代化和可持续发展政策对中国浙江省临安種竹业之影响。

研究目的:

1. 搜集到不同專家對中国竹产业的生态转型之看法和意見。
2. 搜集到與臨安竹子生产工业的辅助数据、行业情况和相關資料。
3. 實地考察臨安竹子生产和加工廠和不同持份者訪談。

接受訪問的內容:

- 访问内容包括种竹业的生产和加工日常情况和访问者对种竹业政策的看法。
- 受访者必须在受访之前签署受访同意书。
- 访问所需时间约四十五分钟。
- 访问是自愿性的，受访者有权随时退出访问。
- 访问之前，研究人员会问受访者是否愿意进行录音。

你是否愿意于访问时进行錄音? _____ 會 ， 不會 _____ (請以 X 作记号作选择)

资料搜集的详情如下:

参与访问的考量?

直至目前为止，本人没有发现任何风险。搜集资料只作本人的博士论文写作之参考，本人将不会向任何人或其它机构公开受访者资料。所有访问调查资料将会放入一个密封的纸信封内。研究人员将会签署和写下密封的日期，以保护您的私隐。所有调查资料将保存在一个有锁的文件柜三年。三年之后，受访资料将会被销毁。

受訪者需要提供甚麼資料?

- 于接受访问之前，研究员**必须获得受访者书面同意和签署**。
- 于接受访问之前，研究员必须说明访问是自愿性的，受访者有权随时退出访问。
- 若受访者同意，受访者的身份可由匿名或化名代替。
- 研究人员将提供联络方法，以便受访者作出任何查询。
- 所有资料只作研究员的博士论文写作参考，研究员**不会将受访者资料向第三者或其它机构公开**，以保障受访问者的私隐。

签署 (書面同意):

你的签署表明你 1) 明白参与此研究的目的和角色，2)且愿意成为受访者。
由于受访者参加访问出属于自愿性质，在任何情况下，不能向调查员、资助机构或何参与机构追讨任何法律或专业责任。如受访者不愿继续进行访问，可以随时退出。

研究員姓名:____ 陈建荣_____ 受訪者签署:_____ 受訪日期 :_____

問題或查詢:

如受访者对本人的研究有任何意见或查询，可透过以下方法联络本人:
研究人員: 陈建荣(博士生), 英国卡迪夫城市规划学院(电話): +44 29208 75170, (电郵) ChanK9@cardiff.ac.uk

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研究人员将受访同意书复制一份给你保存，而研究人员则保存一份留底。

Appendix 7

In-depth interview questions

1. After the implementation of 1982 household responsibility system, forestlands had been distributed to farmers, then what were the policy impacts toward

farmers' households?

2. In 1984, the city government encouraged farmers to grow bamboos on the slope lands and hilly areas through the policy of "what you plant what you get?" What were the policy impacts toward the Linan farmers?

3. In 1992, *taiwuyen* township promoted the early shooting technology on the *Ph. Praecox* bamboo shoots, what policy influences had influenced toward Lin'an bamboo shoot production industry?

4. In 1986-1988, the city government gave an allowance of 20 renmenbi per mu to encourage farmers to grow *Ph. Praecox* bamboo shoots? Where were the incentives of farmers to grow *Ph. Praecox* bamboo shoots?

5. At what time did the Lin'an state allow farmers to grow *Ph. Praecox* shoot on their farmlands? What were the Lin'an state's actions?

6. In the 90s, famers started to grow a large amount of *Ph. Praecox* bamboo shoots in their farmland, what influence did it bring to the paddy farming?

7. What were the strategies of the Lin'an state to stabilize bamboo shoot market prices?

8. The Lin'an forestry department categorized bamboo forests both as an economic forest and vegetable. How did Lin'an agriculture department perceive bamboo shoot as forest product or an agricultural product?

9. During the 1990s and 2000s, the Lin'an state started to develop the processing industry of bamboo shoots and did the development of processing increase bamboo shoot farmers' income?

10. The Lin'an state collaborated with bamboo shoot market traders and processers to promote bamboo shoots to the Northeast, Northwest and to the Guangxi provinces, did it increase the income of farmers?

11. What are the positive impacts to develop fresh bamboo shoot markets in Lin'an County? Does it helps to sell the fresh bamboo shoots to the urban vegetable wholesaling market?

12. Does the industry integration among farmers households, production bases, and processing industry is a sustainable development model for Lin'an bamboo shoot production industry?

13. What are the purposes to establish provincial and county levels of bamboo shoot production bases?

Please evaluate the scale of impacts of the hazard-free production standard : ① Big ②Small

Fertilisers' aspect:

A). Agriculture fertilisers

①animal waste

② Human deposit

B). Chemical fertilisers:

①Bio-organic fertilisers

② Composted fertilisers

③Combination of both organic and inorganic fertilisers

④Inorganic fertilisers

13.1 What is the amount of fertilisers being used under the standard?

13.2 Pesticide aspect: What kinds and amounts of pesticides are allowed according to standard?

13.3 Have you got any hazard-free production standard's certificate?

14. Apart from the hazard-free production standard, what are the development of green food and organic foods production standards in Lin'an County?

15. What were the progress and development of Lin'an farmers from misusing of fertiliser and insecticides to apply the hazard-free production standard?

16. What are your comments on Lin'an bamboo shoot processors and farmers to recycle the husks and wasted parts of bamboo shoots?

17. To what extent the following concepts have influenced farmers to apply the hazard-free production standards?

	No effect	Effective	Very effective
①Scientific			

development			
②Economic efficiency			
③Circular economy			
④New rural socialist construction			
⑤Sustainable development			

18. What are the main reasons to promote the hazard-free production standards?

	No	Yes	Very influential
① Market demand on healthy and safety foods			
②Poisons shoots do not have market			
③State's regulations			
④Change of farmers 'thoughts			
⑤Change of structure of market			

Please explain the above reason:

_____

19. Since the 2000, the soil degradation have transformed the Lin'an rural society and produced four social phenomenon, what do you think about the following changes?

	Social phenomenon	Types of Farmer
Case 1	Florist bamboo plantation, grow plenty of *Ph. Praecox* shoots and subcontract others farmers' lands	Pro-active farmers
Case 2	When the *Ph. Praecox* started to degenerate, or the owner went out for work, the bamboo shoot plantation was degraded	Part-time farmers
Case 3	When the *Ph. Praecox* shoot plantation was degraded, the owner went to the city for work.	Abandoned farmers

	However, due to the care of hometown, even though the land was abandoned, he doesn't subcontract to other farmers	
Case 4	The owner works in the city, then he subcontracts or sells the land to others.	Subcontract farmers

19.1 Does the above four social phenomenon happened in *Taiwuyuen* County?
①Yes, it does ②No, it doesn't

19.2 If yes, what do you think about the proportion of these four cases of farmers in *Taiwuyuen* County? (Using 100% for calculation)

19.3 What are your comments and opinions for these four types of farmers in rural Lin'an?

① Pro-active farmers
② Part-time farmers
③ Abandoned farmers
④ Subcontract farmers

20. Evaluate the extent of the method of testing the soil and matching the fertiliser to bring sustainable development for the bamboo shoot production industry?

21. Does the subcontracting of land increase the scale of manufacturing of bamboo shoots?

①Yes, it does ②No, it doesn't

22. If increases the scales of bamboo shoot production, will it promotes the hazard-free and green shoots productions?
①Yes ②No

23. The Lin'an state develops agriculture scientifically, if the state uses scientific technology to transform the seasonality and growth rate of bamboo shoots, do you think this is a sustainable way of growing practice which should be promoted?

24. Farmers who are living in the mountainside grow Torreya Grandis and Hickory nuts to deal with the degradation problem of bamboo forests by increasing the biodiversity. Do you think it provides a long-term solution to achieve development?

25. Assess to what extent the following ways of integration can promote hazard-free production standards?

Ways of industry integrations	Limited Influences	Influence particular co-operations	Influence the whole bamboo shoot production industry
①Production base+Farmers+Processing plants			
②Cooperatives+farmers+Processing plants			
③Middlemen+Farmers+Processing plants			

26. Do you think the fresh bamboo shoot production reached the following standards?

	Compliance	Non-compliance
①Hazard-free		
②Green food		
③Organic food		

27. What are the major reasons to increase farmers' incentive to grow bamboo shoots?

	No impact	Small impact	Large impact
① High profitability			
② The state's guidance			
③ Low profit margins of other food crops			
④ High profit margin of bamboo shoots			
⑤ Small landholdings and obtain higher economic effects			
6. Other factors			

28. Do the processing plant and the cooperatives supply hazard-free technology and standards?

29. How do you define the concept of sustainable development?

30. Does the price given by processing plants and cooperatives higher than the market price so it attracts farmers to adopt the hazard-free production standard?

31. Do the contracting between processing plants, cooperatives and farmers further promote hazard-free food production standard?

32. To implement hazard-free, green and organic manufacturing, what problems will be encountered? Are there any other manufacturing problems?

33. Evaluate how does the bamboo shoot processing industry achieve the following manufacturing standards?

	No effect	Can affect individual processor	Affect the whole industry
<u>Processing aspects</u> ①Quantity of salt ②Food additives usages ③Technique improvements ④Hygiene standards			
<u>Food labeling and brand protection</u> ①Good Management Practices (GMP) ②Hazard identification and Key Point Control (HCCP) ③ISO9000(Quality management) ④ISO1400(Environmental management) ⑤Combat the counterfeit goods 6.Registration of copyrights			

Appendix 8

Major policies	Year	Critical event	Relation to the Sustainable development concept
	1978	China's market reform	
Bamboo Forest Land Contracting system • State-owned forest • Rural-collective owned forest • Privately-owned forest	1980	The Lin'an municipality launched the Household Responsibility System and contracted out bamboo plantation rights to individual. Lin'an municipal called this policy as " Sān Ding Policy"	Industrialized the bamboo production to regenerated degraded slopes after massive of deforestation during the Cultural Revolution between 1966 and 1976 Household Responsibility System increased farmers' incentive to conserve and manage bamboo plantation. The delineation of the boundary of the forestry property provided two major ecological benefits. (1) Clearer delineation of forestry rights help local state to regulate individual farmers' yearly cutting and productivity. (2) it facilitated individual farmers' responsibility on bamboo's caring.
	1982	Conducted Forest and Land Resource Survey was launched to identify highest economic returns' bamboo shoots	
	1984	Lin'an Foresty and Agricultural Bureau submitted the proposal *Bamboo and its further Development and Utilization in Lin'an*	
	1985	The Lin'an Municipality adopted the proposal to developed 6, 667 ha of industrialized bamboo shoots nursery. Policy emphasizing nurturing bamboo shoots types and seedling bases	Regenerated degraded slope and propagation of forests
Bamboo Plantation Supporting policies • First subsidy for bamboo cultivators	1986	Launched the Bamboo Shoot Production Financing system 100 million yuan subsidy for **bamboo cultivation** Bamboo Industry Association was established	Institutionalizing the regulations of the priority of cutting and subsidizing systems in the bamboo production shape the behaviours of bamboo producers and processors. This research hypothesized that there are four major behaviours: (1) Transform from rural collective production to private production: legalize private ownerships and provide funding for bamboo farmers to operate their bamboo forests. (2) Imbue farmers to choose productive bamboo seedlings and manage their forest skilfully

	1990	Lin'an Forestry Bureau started to provide technical services and enterprises to bamboo producers and processors 1. Technical trainings, demonstration household, technical service contract, and promote practical and high impact research	
Bamboo Forest Cutting Priorities Policies	1994	The difficult to process "fresh shoots' products" because of shoot processing technology was outdated Policy emphasizing the productivity of shoots' cultivation	(3) Imbue the concepts of scale of production and priority cutting
	1995	The Lin'an municipality provided 1. 5 million yuan to subsidy the shoots and culms **processing industry** Bamboo shoot cultivation land reached 6, 930 ha in Lin'an	(4) After building up the production base of bamboo, the government shift the focus to construct the processing industry. Provide technical and funding supports to bamboo processors to carry out bamboo processing.
Bamboo Supply-Chain Management Policies Bamboo Production Tax System	1997	Lin' an Bamboo Shoot Association was established Lin'an became the largest bamboo shoots trading markets (i.e. boiled and dried shoots) Policy emphasizing processing and marketing of bamboo shoots	
	1998	The Lin'an Municipality started the eco-tourism, encouraged the cultivation of bamboo on hilly slope, and launched the Natural Forest Conservation Project by growing NTFP (hickory, ginko, and torreya grandis etc.)	
Second stage of financial supporting scheme (1991-2003)	2001	Japan was the only exporting market of Lin'an bamboo shoots	
	2002	Farm stay in bamboo producing villages became popular	
Third stage of financial supporting scheme (2004-2008)	2004		
Eco-forest	2005	47 processing bamboo shoot processing factories Started the "Eco-forest" construction project and two areas were designated as "Natural Conservation Areas" in Lin'an	
Hazard free production standards	2007	Emphasized the construction of ecological forest (pollution-free shoots production) and the assessment of the forest management	(5) The current stage, the state imbues the bamboo producers and processors to pay attention on "biodiversity" "ecological sustainability" and "product sustainability", and "marketing".
Fourth stage of financial supporting scheme (2008-2009)	2008		
Carbon trading of the bamboo production industry	2009	Signing the Lin'an Declaration	(6) Economizing the ecological services to achieve sustainable development

Appendix 9

CH4
P20

竹子不一定是群集式生长，可单行式种植。
“bamboo shoots grow in clusters which could be distributed in strip forms” (In-depth interview, No F03, 2012)

敞若农民不获肥沃的土地，这是他的不幸因他有同等的抽签机会拿肥沃的土地。

“if a farmer could not get fertile forest lands, this was the farmers’ bad luck because they had a chance to shuffle the good lands as same as the other farmers” (In-depth interview, No F03, 2012).

对我们来说，市场定价和买卖机制都非常陌生；我们不知道什样只靠自己开始进行资本主义的生产模式因为我们习惯了当时国共时期的集体生产模式。我们偏向听取生产队的产量需求和指引进入自由市场经济模式。因此，当我们受到农作物收集队对我们生产竹笋的鼓励，我们便跟随农作物收集队的指导和邻居的耕种经验，我们遵循了比较合适的方法。

> Market prices and mechanism were completely new to us; we didn’t know how to start capitalist production by our own because we got used to the collective production during the communist period. We prefer receiving production commands and guidance from the production brigade to free market economy …therefore, we followed the rural collectives’ guidance and our neighbours’ farming practices when the rural collectives encouraged us to grow [ph. Nuda and moso] bamboo shoots, we followed suits (In-depth interview, F10, 2012).

P34

土地调配被冻结是倒退的，是不公平的，因为 1998 年后加入的家庭成员不获得土地分发。比喻说，在 1983 年，我家有三个家庭成员，我便拥有三畝竹林地并负责管理。随着时间，我家增添了两人，所以 2000 年后我家总共有五名成员。但从 1998 年起，我们村里的人口一直变动，如我邻家的女儿嫁去安吉县了，临安县的竹地主权并没有因此而重新调配，我家依然只拥有三畝竹林地来生产竹笋。

> The freezing of land adjustment was regressive and unfair because there is no land distribution for my new added family members after 1998. For instance, my family has three family members and I obtained three plots of responsibility forestland in 1983. As time went by, now added two more members and totally had five members in my family in the 2000s. Since 1998, there was a population changed in our village like my neighbour’s daughter was marriage to Anji County; the there was no adjustment for the

land holding in Lin'an County, my family still owned three plots of lands to produce bamboo shoots (In-depth interview, No F14, 2012).

CH5
P6

在毛泽东时期，我们在六十年代都很贫穷。我们大多数的房子都用泥和草建成，以瓦片建顶。七十年代起，我们便使用沙石，泥和混凝土来建屋。直到 1988 年，大部分的农民开始种植竹笋而富有，他们可用砖头来建造摩登的平房以享受更好的生活，我们称之为竹笋屋。

During the Mao's era, we were very poor during the 1960s. Most of our houses were tile houses built with mud and grasses…In the 1970s, we used the sand, mud, and some concrete to build the houses. Until 1988, most of the farmers started growing bamboo shoots and get rich, they could enjoy better livelihood by using bricks to build the modern flat top houses, we called it bamboo shoot house (In-depth interview with Xia Gao village F05, 2012).

P13

国家林业局提供了主要的理念和政策指令给不同的省和县于森林管理和保育上。在浙江省，浙江省林业厅管理的国有林地和保育政策，并监督国家林业局所委托的计划。临安县政府和林业厅是主要的执行者把这些计划以可行务实的方针来实现。

The State Forestry Administration (SFA) provides governing concepts and policy directives for different provinces and counties in forest management and conservation. In Zhejiang province, the Zhejiang Provincial Forestry Department managed state-owned forestlands and conservation programs, and supervised the plan delegated by the SFA. The Lin'an County government and the Forestry Bureau are the crucial players to implement those plans into workable and pragmatic goals (Interview with an INBAR official in Zhejiang, I01, 2011).

P14

所有由中央政府下达给地方政府的计划应严厉执行；下层政府要坚持执行上层政府的政策。例如，有三个主要政策方案：(1) 中长远方案(2006-2020)，(2) 五年计划，和(3)从国家林业局的层面到省林业厅的层面的一年计划。当浙江省林业局获得了中长远方案和五年政策后，省林业厅便可把这些方案成为务实可行的计划给临安县林业厅。

All plans from the central to local state should be implemented strictly; lower levels of governments have to adhere strictly to the upper state's plans. For instance, there are three major types of plans: (1) mid and long-

term planning[44] (2006-2020), (2) five year plan, and (3) yearly plan from the level of State Forestry Administration (SFA) to the county level of forestry Bureau. Once the Zhejiang provincial forestry bureau receives the mid-long term plan and five year's plan, the bureau had to turn those plans into pragmatic programmes for the Lin'an County Forestry Bureau (Indepth Interview with INBAR official I02, 2012).

要衍生成科学数据，我不单只与一位农民合作，借他一小块土地来进行实验；亦要与浙江农林大学合作，连续三个月内不分雨季和雪季收集泥温和笋的生长率。每天早上，我从市内踏单车到下乡去测量用米糠、胶网和毛竹叶而造的遮盖所形成的毛毯效应和上升了的泥温。这方法可以提高雷竹笋的生产表现从而满足农历新年前的市场需求。提早生产的雷竹笋在农历新年前的市价可升至 4 元，但同一数量的雷竹笋在 1998 年只卖得 0.4 元一公斤。

To generate scientific data, I not only cooperated with one farmer household to borrow his small plot land to conduct experiment but also collaborated with the Zhejiang Agricultural and Forestry University to record the soil temperature and rate of shooting in three months continuously no matter in raining and snowing seasons. Every morning, I rode a bicycle from the city to the rural field to testify the appropriate covering materials to create a blanket effect and increase the soil temperature by using rice husk, plastic net, moso bamboo leaves. This method could increase the performance of the shooting of *Ph. Praecox* shoots to meet market demands before the Chinese New Year. The market price of the early shooting *Ph. Praecox* shoot could earn 4 Yuan before the Lunar New Year; while the normal shooting's shoot was just 0.4 Yuan per kilogram in 1998 (In-depth interview of government official G02, 2012).

P27

大部份在临安的农民的教育水平不高，并且不信任任何新科技和技术，除非他们亲眼看见那些科技的真实表现。所以示范户担当着重要的角色来显示新科技在农地的使用方法。一旦其他农民看见示范户成为富户，这样便会推动他们效法我们来使用新科技在农地上。

Most of the farmers in Lin'an are not well educated and they don't believe any new technology and technique until they have seen the actual performance of the technologies. So, demonstration households play a crucial role to show how the new technique works in their fields. Once other farmers see that the demonstration household become rich, this will drive them to try new techniques and earn lots of money like us (Translated by author) (in-depth interview with a demonstration household D03, 2012).

P27

作为一名示范户，我更加注重林地管理包括我对化学肥料的使用意识，水源管理，和使用无公害标准。例如，我知道若果我使用无公害的标准来种植我的竹笋，我是在保障我买家的健康，所以，我有责任展出我最好的竹笋收成。

> As a demonstration household, I pay more attention to forest management including my awareness of chemical fertilisers' usages, water management, and applying pollution free production standards. For example, I understand that if I apply pollution free production standard in my bamboo shoots' plantation; I am protecting my buyers' health; therefore, I have the responsibility demonstrate my good practice in bamboo shoot cultivation (Translated by author) (in-depth interview with one demonstration household D05, 2012).

P28

示范户将要面对四项挑战。其一，大部分农民的教育水平不高，他们很抗拒科学和新科技。他们并没有很强的意欲向我们学习。其二，农民间很喜欢比较并不欲教晓其他农民如何致富– 什至那些示范户。我称这想法为小农经济思想。其三，大部分农民在尝试新科技以先都抱持观望态度。所以，要传播新科技还需要一段长时间。其四，科技扩展成本非常高。比喻说，提早产笋的科技材料费不是所有农民都能支付。

> There are four major challenges to become a demonstration household. First, most of the farmers were not well educated; they are sceptical to science and new technology. They may not have a strong incentive to learn from us. Second, farmers like to make comparison and they don't want to teach other farmers to get rich -- even the demonstration households. I called this ideology the 'little farmer economic mentality' (Xiaonong Jingji sixiang 小农经济思想).Third, most of the farmers will maintain look and see attitudes before trying the new techniques and technology. So, the diffusion of the new technique is time consuming. Fourth, the cost of technological extension can be costly. For instance, the

material costs of the early shooting techniques are not affordable to all farmers (In-depth interview with a demonstration household D06, 2012).

Appendix 10

CARDIFF SCHOOL OF CITY AND REGIONAL PLANNING

Ethical Approval Form

Staff and MPhil/PhD Projects

The completed form must be submitted at least TWO WEEKS before a SREC meeting to: Ruth Leo, Research Administrator / email: LeoR@cardiff.ac.uk / Tel Ext: 75280/ Room 2.61 Glamorgan Building)

Title of Project:

Rethinking sustainability: a study of ecological modernisation in the bamboo production industry in Lin'an, China

Name of researcher(s): Kin Wing (Ray), Chan

Date: 10-7-2012 **Signature of lead researcher:**

□

Student project : PhD Research Project

Anticipated Start Date of Fieldwork: 15th, August 2012

Recruitment Procedures:		**Yes**	**No**	**N/A**
1	Does your project include children under 16 years of age?		**X**	
2	Have you read the Child Protection Procedures below?			**X**
3	Does your project include people with learning or communication difficulties?		**X**	
4	Does your project include people in custody?		**X**	
5	Is your project likely to include people involved in illegal activities?		**X**	
6	Does your project involve people belonging to a vulnerable group, other than those listed above?		**X**	
7	Does your project include people who are, or are likely to become your clients or clients of the department in which you work?		**X**	
8	Does your project include people for whom English / Welsh is not their first language?	**X**		

*** Cardiff University's Child Protection Procedures:**

http://www.cardiff.ac.uk/racdv/ethics/guidelines/ChildProtectionProcedures.pdf

If you have answered 'yes' to any of the above questions please outline (in an attached ethics statement) how you intend to deal with the ethical issues involved

Data Protection:		**Yes**	**No**	**N/A**
9	Will you tell participants that their participation is voluntary?	**X**		
10	Will you obtain written consent for participation? If "No" please explain how you will be getting informed consent.	**X**		

11	If the research is observational, will you ask participants for their consent to being observed?	**X**		
12	Will you tell participants that they may withdraw from the research at any time and for any reasons?	**X**		
13	Will you give potential participants a significant period of time to consider participation?	**X**		

If you have answered 'no' to any of these questions please explain (in your ethics statement) the reasons for your decision and how you intend to deal with any ethical decisions involved

Possible Harm to Participants:		**Yes**	**No**	**N/A**
14	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?		**X**	
15	Is there any realistic risk of any participants experiencing a detriment to their interests as a result of participation?		**X**	

If there are any risks to the participants you must explain in your ethics statement how you intend to minimise these risk

Data Protection:		**Yes**	**No**	**N/A**
16	Will any non-anonymised and/or personalised data be generated and/or stored?		**X**	
17	Will you have access to documents containing		**X**	

	sensitive45 data about living individuals? If "Yes" will you gain the consent of the individuals concerned?		**X**	

If there are any other potential ethical issues that you think the Committee should consider please explain them in an <u>ethics statement</u>. It is your obligation to bring to the attention of the Committee any ethical issues not covered on this form.

Health and Safety:	**Yes**
Does the research meet the requirements of the University's Health & Safety policies? (http://www.cardiff.ac.uk/osheu/complete risk assesnebt/index.html)	**X**

<u>Please attach:</u>

- Full project proposal
- Participant information form and Consent form (if available)
- Details concerning external funding (if applicable)
- An ethics statement (if needed based on your answers to the questions on the form – please enter onto the following blank page).

<u>Finally please note also</u> that the Ethics Committee must be notified immediately by the researcher/supervisor when the nature of the project proposed changes significantly from that originally approved by the committee

45 Sensitive data are *inter alia* data that relates to racial or ethnic origin, political opinions, religious beliefs, trade union membership, physical or mental health, sexual life, actual and alleged offences.

(A) Ethics Statement:

- Full project proposal is attached (see Appendix 1).
- Participant consent forms are attached (English and Chinese version) (see Appendix 2).
    - Participant observation form and in-depth form.
- **The ethics statement for question number 8:**
    - This research project is conducted in Mainland, China and the interviewees are Chinese citizens. Therefore, the participants are speaking in Mandarin. In fact, the researcher can speech mandarin and prepare the Chinese version of (1) proposal (in brief), (2) informed consent form, (3) recommendation letter from Dr. Andrew Flynn for my informants in China (see Appendix 3).
- Chinese version of proposal (Chinese version), informed consent form, and recommendation letter from Dr. Andrew Flynn are attached (see Appendix 4).

The researcher does not foresee any risks deriving from participant in this study. The information being collected will be used in researcher's doctoral dissertation only. All information related to in-depth interview will not be shared with third party any or other participants or organizations. All of the interview information will be kept in a filing cabinet within a locked office.

(B) Strategies to protect informant's privacy:

- Researcher will ask informants to offer their **signed consent** before their participation.
- Participant will be informed that participation is voluntary and participant may withdraw at any time during the interview. All information provided by any withdrew participants will be destroyed and will not be used in any publications.
- Researcher will provide his contact information to participants so that they can ask any questions and receive clarification.
- All information which participants provided will be used in the researcher's doctoral dissertation only; it **will not** be shared with any third party or other farmers or organizations.
- All observational data will be destroyed after three years.

Signature:

Date