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**AGENCY, TEMPORALITIES AND THE MEDIATION OF COVID WITHIN
GLOBAL PRODUCTION NETWORKS**

Dr Crispian Fuller

School of Geography and Planning

Cardiff University

Glamorgan Building

King Edward VII Avenue

Cardiff

Wales. CF10 3WA

Fullerc2@cardiff.ac.uk

ABSTRACT

While the Global Production Networks (GPN) approach produces important conceptual insights into the causal factors influencing global production networks, studies have been less concerned with the temporal intricacies of decision-making by actors. This paper extends the GPN approach by examining why and how firms in the Welsh automotive sector have constructed and performed particular temporalities in response to the upheavals of Covid. A process philosophy perspective is utilised for examining how temporalities are socially constructed by human actors through ‘actual occasions’. Actors ‘weave’ the past, present and future together in socially constructed temporalities, which are imbricated with the spacetimes of actual occasions. The paper finds that the temporalities and spacetimes of actions to mediate Covid have been configured around reducing and maintaining costs, and increasing risk management.

GLOBAL PRODUCTION NETWORKS
PHILOSOPHY

TEMPORALITIES

COVID

PROCESS

INTRODUCTION

In a world characterised by global production networks (GPNs), the effects of the Covid pandemic on production, distribution and consumption was substantial during the 2020-22 period (Bailey et al., 2022). Supply chains were negatively affected by lockdowns in Southeast Asia, producing a global shortage in components and raw materials, less predictable supplies and their cost inflation in the automotive sector (Golgeci et al., 2020). Existing studies on responses to Covid within automotive GPNs indicates that short term actions were prolific (e.g. contingency planning with suppliers), and that more substantive restructuring was less evident (Spieske and Birkel, 2021). Nonetheless, these measure were highly uneven and faced many challenges in the short term, suggesting that there are important empirical questions regarding whether actions are focused on costs, the development of new capabilities and the extent of changes to risk management.

Following thinking in the Global Production Network (GPN) 2.0 approach, important and immediate firm responses to Covid can be conceptualised as effecting and constituting the ‘cost-capability ratio’ and risk management of global production networks that influence firm strategies and the organisational arrangements of networks (Yeung, 2022). However, while a number of aspects of the GPN approach have been developed, there has been far less concern with how actors subjectively interpret time, and create and take action through the construction of temporalities, as well as the spacetime relations of such actions (Barratt and Ellem, 2019; Fuller, 2021a). This is not to suggest that time is ignored, but that it is conceptualised as objective, sequential and linear. In contrast, process philosophy views the past, present and future as imbricated within ‘actual occasions’ of experiences, where actors interpret and construct reality and actions that involves the utilisation of particular conceptions of time (Hernes, 2014).

Focusing on a case study analysis of the automotive sector in Wales, and utilising a process philosophy ontology, this paper examines why and how GPN actors have constructed and performed particular temporalities in response to the production network disruptions caused by Covid. This involves the examinations of production relations, costs, capabilities and risk management through interviews with case study firms. Such an approach makes it possible to discern how the responses to Covid in the ‘present’ are influenced and constituted by the temporalities of the past and future.

The paper is structured by way of firstly reviewing how time is conceptualised in the GPN approach, before elucidating the nature of reality, socially constructed representations and the conceptualisation of time in process philosophy. With key concepts drawn from process thinking, the analysis proceeds with the examination of efforts at maintaining, negotiating and transforming global production networks. In conclusion, the results indicate that the mediation of Covid involved multifaceted temporalities of reducing and maintaining costs, greater risk management, and no major investment in new capabilities. More broadly, a process philosophy perspective explicates how the past, present and the future are interwoven in actual occasions constituting reality and spacetime.

GLOBAL PRODUCTION NETWORKS, TEMPORALITIES AND PROCESS ONTOLOGY

Time and temporalities in Global Production Network thinking

The Global Production Networks 1.0 and 2.0 perspectives are critical in examining the contemporary configuration of regions with broader networks of value creation and capture (Coe and Yeung, 2015). GPN 1.0 advances a perspective concerned with the social constructivist relations of value, power and embeddedness in the spatial organisation of regional and global production. GPN 2.0 developed as a means of addressing criticisms of GPN 1.0 lacking a concern with causal mechanisms (e.g. Sunley, 2008). Implicit within these approaches is the belief that production networks, actors and coupling

with regions occur and change over time through particular events. For Barratt and Ellem (2019), GPNs are ‘time made visible’ and that efforts to use, manage and control time are critical. However, this is very much in the sense of understanding time as objectivised, linear and sequential within GPN studies, rather than examining the social construction of time (Barratt and Ellem, 2019; Fuller, 2021a).

Sequential and linear time is perceived as underlying the value creation process through constantly operating and dynamic network relations and regional coupling. Changes take place ‘in time’, with notable emphasis on the timings and duration of actions (e.g. enactment of cost cutting) and relations (e.g. reconfiguration of supply chains through deliberations) (e.g. Butollo, 2015). Studies frame this in terms of objectivised turnover times in the relational transfer of components through supply chains and to the market, and which shapes the spacetime trajectories of actors, relations, production and forms of coupling (e.g. Baker and Sovacool, 2017; Breznitz et al., 2023). Actors therefore make decisions and enact actions that produce changes and discontinuity in production relations and with forms of regional coupling, and which are framed in terms of the sequence of time. This forms the basis of accounts explicating the impacts of actions in the progression of time, demarcating a past of continuity from a present of change, and a different future.

This is notable, for example, in accounts such as Butollo’s (2015) examination of the recoupling of Chinese garment producers to lower cost sites, while also reconfiguring production for the domestic market and higher value added export markets. Butollo (2015) argues that there has been strong clustering path dependencies that influences recoupling, with the past viewed as conditioning present decision-making and constituting ‘competitive advantages in the future’ (Butollo, 2015: 533). Time is thus critical but there is far less concern with examining how firms socially construct time as temporalities to be deployed in defining reality and achieving aims. This includes how garment firms in the Humen and Dalang clusters constructed temporalities in deliberations with suppliers and local government in developing new competitive advantages.

Viewing time in such ways means GPN 1.0 and GPN 2.0 studies are vulnerable to internalising broader criticisms within social sciences. Most notably, the subjective experiences and perceptions of idiosyncratic human actors are not embedded within objective, linear and sequential time (Thrift and May, 2001; Ho, 2023). Actors comprehend time differently due to divergent experiences, knowledge, beliefs, norms, values and social relations, all of which produce temporal complexities (Ho, 2023). The production process may well be characterised by sequential production, but processes and relations take place through the decision making of agency that is influenced and constituted by these disparate complexities, leading to a multiplicity of temporal awareness (Hernes, 2014).

A sequential and linear view of time is further notable in the GPN 2.0's framework for the creation and adjustment of costs, capabilities and risk management, with these processes being important in relation to immediate firm responses to upheaval and uncertainties (Yeung, 2022; Fuller, 2021b, 2023; Völlers et al., 2023). These 'causal drivers' of GPNs influence 'lead' and 'strategic partner' firm strategies that produce particular GPN organisational arrangements, while lower tier suppliers seek to maintain and enhance their position through changes to their costs and capabilities (Coe and Yeung, 2015). Firms develop particular configurations of costs (e.g. labour costs), and development and utilisation of capabilities (e.g. technological knowhow), with the aim of capturing and enhancing value by reducing costs and using requisite capabilities in fulfilling production tasks. They seek to gain competitive advantages through time-based efficiencies as part of cost-capability ratios, with such processes viewed in terms of linear and objective clock time (e.g. Lund and Steen 2020; Afewerki and Steen, 2022; G. Yeung, 2023).

Yet, this ignores how cost-capability ratios (as a 'managerial device') are subject to the types of disparate social processes and actors explored above, and how they are consequently constituted, influence and are influenced by performing particular temporalities (Barratt and Ellem, 2019; Fuller,

2021a, 2021b). For instance, Afewerki and Steen's (2022) analysis focuses on the sequential and objectified analysis of industry life cycles and forms of GPN organisation. This involves lead firms developing competitive capabilities through firm specific internal practices and external relations. These are conceptualised by way of sequential life cycles, rather than the analysis of particular temporalities by actors in capabilities development, or how the past is configured through the present. Similarly, Zheng's (2023) account is critical in highlighting the multi-dimensional 'strategic choices' facing firms. However, the role of the social construction of temporalities that are critical to strategic actions (see Hernes, 2014), such as in the embedding of past experiences in present representations of reality that define choices, is ignored (see also G. Yeung (2023) on the influence of 'megatrends').

Finally, firms 'risk' manage environments characterised by upheaval and uncertainties. Given the interdependencies between firms within GPNs and across geographical spaces, risks are geographically widespread and occur beyond the control of individual actors, but firms still have to mediate such risks (Fuller, 2023). For Coe and Yeung (2015), uncertainties are managed as risks through measurement, calculation and prediction by actors, which is critical in cross-border production relations. Within GPN 2.0 thinking, the onus is very much on risks and their management through Knightian rational judgement (Völlers et al., 2023), and occurring in sequential time (see, for example, Yang and Yuen-Tung Chan, 2023). There is far less concern with how risks and their management are socially constructed by actors and society in terms of their frequency, duration, impacts, and the extent to which they can be mediated (Geenan, 2019). Yet, agents construct temporalities, with time deployed as a cultural resource guided by particular motives, and used to maintain production networks (Fuller, 2023).

The temporalities of agency: A process ontology perspective

Process philosophy provides a critical conceptual lens in which to examine the interpretations and actions of actors, facilitating a deeper understanding of how time is interpreted, experienced and

utilised (Hernes et al., 2021). For Harvey (1996), the approach explicates how reality is in a state of flux and ‘becoming’ through constantly changing processes. Whitehead (1929), as a critical proponent of process philosophy, argues that time is a continual process of becoming that occurs through ‘actual occasions’ of experience, with the direct experience of temporal flows realised through continual ‘events’ in the present (Weik, 2004). Such thinking is comparable to social constructivist accounts in human geography, such as Crang (2001) who argues that ‘time is an experience of flow rather than being a series of static images enchaind in a sequence’, suggesting a focus on processes of temporalities (206).

For process philosophy, human agency can only sense aspects of reality, rather than fully comprehend its complicated nature (Weik, 2004). Fundamental to this is how human actors create representations to understand this partially sensed reality, and how this leads to particular temporalities. Representations of reality and time are influenced by disparate experiences, knowledge, beliefs, norms, values and social relations, further advancing a more nuanced account of human actors (Hernes, 2014). This is congruent with human geography accounts that argue how everyday subjective temporalities are produced as actors experience, interpret, frame and perform time in particular ways, meaning agency is critical and actions are emergent and heterogeneous (Merriman, 2011; Ho, 2023). Adopting such an approach thus provides a framework for GPN studies that places the constrained, subjective and disparate perceptions of human actors and their temporalities at the heart of the analysis, and focusing on the causality of human agency in ways that are more prominent than many studies.

In ways that are comparable to aspects of non-representational and Deleuzian inspired human geography accounts, process philosophy argues that this sensing takes place through ‘actual occasions’ of experience that produces spacetime. Once they have occurred they transform into ‘data’ (‘Objective Datum’) that has the potential to transition into new ‘actual occasions’ of experience (through ‘prehension’) as actors interact with reality (Weik, 2004). Correspondingly, Whitehead (1929)

conceptualises ‘events’ as a ‘nexus of actual occasions, interrelated in some determinate fashion in one extensive quantum’ (29). In contrast to sequential time as ordering social reality, a process ontology therefore views the role and importance of past, present and future events as continually changing depending on how they are being interpreted, given meaning and organised by actors (Hernes, 2014).

The actuality of an event in the present has the ‘potentiality’ for new combinations in future events, whilst drawing upon past events. In a constantly changing present, actors continually define and redefine the role of past events and their consequences for different futures, which influences and constitutes their perceptions and actions in the present (Mesle and Dibben, 2016). There is no continuity with the past based on sequential historical ordering of events in time, because it is actors that ‘weave’ the past, present and future together in forming perceptions and actions, and in doing so they create the present (Hernes, et al., 2021).

For Whitehead (1929), the process of connecting with the past involves ‘prehension’ as there is the coming together of past events, as ‘data’ (e.g. social relations), to form present and future events (through ‘concrecence’), with the meanings and feelings of past events facilitating their connection across spacetime. Through weaving, actors have the agency to construct interpretations of the present and with that the sense of continuity or discontinuity and change with the past, as they determine the role and importance of past and future events (Hernes et al., 2021). Such thinking is comparable to human geography accounts examining the temporal construction of social regulation and predictability by actors (e.g. cycles and rhythms), as well as there being temporalities of creativity (e.g. cycles of product investment), and alternative practices and possibilities (May and Thrift, 2001).

While never explicitly conceptualised or critically engaged, GPN studies have limited engagement with such processes of weaving in that they recognise the historically constituted nature of the deliberative relations of GPNs (as is evident in GPN 1.0 studies; see, for example, Murphy, 2012), and

that future orientated motivations underpin actions such as capabilities development (e.g. Baker and Sovacool, 2017). However, the actual conceptualisation of temporalities in such accounts, and their imbrication with spatialities, is not extensively examined. Yet, a focus on ‘weaving’ provides a critical concept in the examination of how GPN actors socially construct temporalities within specific events of actual occasions, and where the past and future are ever present. Nonetheless, there is a need to recognise that temporalities are inexplicably linked to spacetimes.

Spacetime and process thinking

Predating human geography arguments of interwoven ‘timespace’ (May and Thrift, 2003), ‘time-space compression’ (Harvey, 1989) and ‘space-time’ (Massey, 1994), Whitehead argues that actual occasions are not simply located at a particular spatial point or time, but generate spacetime, an appropriate comparable to Merriman (2011). They are constituted by previous events, and the combinations generating these events, which produce particular spacetimes. The present is formed by the constant processes and becoming of objects, actors and actions in the world, all of which create particular spaces and temporalities in combinations (i.e. spacetime). Correspondingly, the happenings of present events, situated within a certain spacetime, have potentialities for future events and combinations, involving the ‘creative advance’ in different temporalities and spaces (Whitehead, 1929). Events are therefore important, as are the spacetimes generated by actors as they weave the past, present and future together through ‘creative advance’.

A spacetime perspective moves beyond a simple concern with pre-specified scalar and territorial configuration of GPNs and position of actors, actions and deliberations, which pervades much GPN thinking. While GPN accounts work on the basis of the social construction of scale through networks, they do not explicitly focus on how scale is produced by actors, is subject to constant change through actual occasions and events involving heterogeneous actions, or is imbricated with time and temporalities. In contrast, Dodge (2020) explicates the assembling of GPNs and regional strategic

coupling within a particular space. Such a perspective is critical in illustrating the coming together of heterogeneous actors, materialities and actions in processes of assemblage and territorialisation. Nevertheless, while temporalities are considered in assemblage thinking it is often in respect to the temporary and uncertain nature of assemblages. There is far less concern with how time and space are imbricated (in contrast to Whitehead's conception of spacetime), or how actors utilise temporalities in the social construction of reality through constant actual occasions.

To summarise, a process ontology perspective provides a critical framework in which to examine the constant becoming of reality through actual occasions, and involving the construction of temporalities by actors. Through this approach, why and how GPN firms have enacted temporalities in response to the disruptions of Covid will be examined, with the analysis focusing on firm efforts to maintain and negotiate production networks.

METHODOLOGY

The paper analyses the automotive sector in Wales because of its relative importance to the Welsh economy, poor economic performance compared with other parts of the UK, and the on-going restructuring of the automotive sector. Wales has a Gross Value added before Covid of £21,010 (2020) compared with a UK average of £28,894, and GDP for manufacturing accounting for 5.8% (ONS, 2023). Employment in the automotive sector totalled c.13,000 workers in 2020, having fallen from 18,000 in 2017 (Welsh Affairs Committee, 2020). The sector in Wales comprises 30 first tier suppliers, and around 119 second and third tier firms.

The research methodology utilises a process perspective with an philosophical framework geared towards recognising and examining a constantly changing reality and 'becoming' of actors (Cloutier and Langley, 2020). Such an approach involves an emphasis on narratives elucidating the causal

mechanisms producing and characterising events (Pallesen, 2017). In recognising and seeking to examine the fluid heterogeneous and interconnected nature of events, and their constitution through processes and actors, there is a need for a two stage research methodology. In the first stage, qualitative semi-structured interviews were conducted with a range of firms, Welsh Government officials and a sectorial association. Four interviews were conducted with the Welsh Government, along with two interviews with sectorial associations and 15 firm interviews, with each lasting around one hour. The topics discussed in these interviews include the pre-Covid operational and supply chain conditions at firms, the impacts of Covid on production and supplier and customer relations, and firm efforts at mediating these impacts through supply chain actions. The purpose of the firm interviews at this stage was to identify and explore common issues, manifest through events. These are then examined in more depth in the second stage where the complexities of the events characterising firm responses to Covid are examined.

The firm interview sample was produced from the Welsh Automotive Forum directory of automotive firms (Welsh Automotive Forum, 2021). All firms were approached (totalling 149), with fifteen firms subsequently agreeing to be interviewed. This includes five first tier suppliers and ten second tier suppliers (See Table 1). Interviews took place with either managing directors/plant managers, or purchasing/procurement and supply chain managers. Their selection was based on ensuring these were individuals who had direct experience of mediating Covid.

[TABLE 1]

In the second stage, four case studies are examined in far greater depth by way of three interviews per firm. The selection of the case study firms is based on them having been impacted by Covid in ways that were congruent with the broader experiences of stage one firms. In order to explicate the challenging situation of dealing with OEMs and second/third tier suppliers, three of the case studies

are first tier suppliers, while one is a second tier firm (see Table 2). There are also equal divides between SMEs and larger firms, as well as UK and foreign firms, in order to ensure the analysis of different experiences. Three interviews were conducted at each firm with the managing director/plant manager, and procurement/purchasing and supply chain/logistics managers, and totalling 12 interviews. Interviews were conducted individually with these representatives rather than in a group, and each lasted around one hour.

Interviews for stages one and two took place from September 2022 to December 2023. All firms and respondents are anonymised because of issues around confidentiality. Interview data was supplemented by content analysis of government documents, research reports and media reports on the automotive sector through Nexis software. Coding and analysis of interview and documents took place through NVivo software.

[TABLE 2]

The analysis focuses on collective actual occasions of experience, as ‘events’, rather than individual actual occasions. An important aspect of this is the analysis of the processes and actors that come to constitute these events through ‘prehension’. A narrative interview approach was adopted for both stages, facilitating an analysis of how participants comprehend reality and their experiences, as well as how they construct temporalities in relation to their experiences in events of deliberation with customers/suppliers (Pallesen, 2017). Examining temporalities translates into interview questions focusing on specific events and responses during Covid and how these related to past experiences and knowledge, and perceptions of future intentions.

GPNs AND THE TEMPORALITIES OF RESPONSES TO COVID

Maintaining global production networks

The upheaval generated by Covid led to annual business plans and longer term strategies being marginalised during Covid lockdowns and into 2022. This was largely because of shortages of particular components persisting throughout this period, leading to increasing costs. From April 2020, temporalities of weekly planning for the amount of production that was required to take place were endemic. A notable instance is that of first tier supplier Alpha which produces automotive, and operates at two sites in Wales employing around 290 workers. It forms part of a corporation with 300 global sites and employing 78,000 workers in 2019. The subsidiary does not control purchasing, which works through the European divisional HQ in Germany, and with production networks configured into mainland Europe and Southeast Asia.

At the end of 2021, Alpha experienced a series of interrelated events associated with serious production network issues stemming from their main OEM UK customer. As part of their long term contract with this customer, there were specific deadlines for a new component associated with the introduction of a range of cars. In these contractual negotiation events, Alpha managers constructed a reality in which there was a set deadline for the first supply of components in late 2021, which was negotiated with the customer based on prehended experiences. Production deadlines are negotiated based on the experiences of supply chain and production tasks in the past, which has accumulated as knowledge to be deployed in these negotiations. The OEM has become a major customer over the years and, as such, there have developed values and norms based on the critical prioritisation of them remaining a customer. The negotiation of time frames with the customer are therefore always one of “bending to their will”, which derives from past negotiations (Procurement manager, author’s interview).

These issues led to Alpha managers creating a reality in which a certain amount of resources (e.g. number of workers), actions (e.g. quality control) and time (production line times) would be required for fulfilling various production orders, but set within the timeframes decided by the OEM. This encompasses a range of functions, from constructing the time required for buyers to identify, negotiate and purchase requisite components, to the requirements around CNC (Computer Numerical Control) quality control tasks during and after production. These realities of planning efforts and capital/labour allocations, and their associated temporalities, had to remain idle because of a delay by the OEM:

“[Anonymised OEM] are launching the [anonymised] in April [2023]. Just before I came on the phone to you I had a meeting where they told me that it has been put back to the 6th June. We're planning for April, so all of a sudden there is a change and we're now planning for June. So those are the things that are coming to us and that's been non-stop for the last two years.” (Alpha Managing Director, author's interview)

The prehensions of this event involved the OEM experiencing significant problems with the availability of semiconductors for certain first and second tier suppliers, which reduced demand for all other components, including that of Alpha. Firms were therefore having to mediate Covid in a uncertain present as segments of the supply chain experience diverse problems at different times, leading to delays in other parts of the supply chain and providing the prehensions of the events experienced by Alpha.

The spacetimes of these GPN shortages and delays across a range of different components, suppliers and geographies, generated everyday experiences of crisis mediation at Alpha and other Welsh firms, focusing on rising costs. This was in ways that had not been experienced before, but where the past is weaved into contemporary actions. Critical to this was the construction of a reality of change from the past, in the sense of the substantial impacts of Covid that were never risk managed by Alpha because of their uniqueness. Importantly for Alpha, these processes were not evident until the event occurred when they were notified of the delay and, as such, it was one of shock but in a landscape where these

uncertainties had been on-going during the Covid period. Alpha's management socially constructed actions and temporalities of reallocating workers to other tasks and products for much longer term orders, whilst reducing production of components for the OEM customer.

When experiencing these disruptive supply issues with the OEM, the response by Alpha managers was to have meetings with the divisional HQ to ensure they were aware of the present delays, and that this would detrimentally impact achieving present and future financial targets because of cost increases. In these meetings, which were interwoven with these events of delays, Alpha managers sought to legitimise a lack of financial turnover in the present because of the many broader immediate past and present supply chain issues of the OEM, which were accumulating to produce contemporary problems for Alpha. A future when such supply issues were resolved could not be accurately projected to divisional HQ managers in these meetings. This was largely because these issues were imbricated with broader, complex intra- and inter-sectorial issues around the supply of semiconductors. The spacetime problems of other parts of the production networks, mainly concerned with the semiconductor supply problems, were therefore prehending into the disruptive operating environment and detrimental financial situation of Alpha.

From the first lockdown until April 2022, Alpha made no profits because of this intermittent demand, leading to substantial costs. It also faced challenges in ensuring the divisional HQ had continuing confidence in the UK operation, not least because it lacked data on when the OEM's other supply chain issues would be resolved. The temporalities created by the subsidiary managers in divisional HQ meetings were therefore about creating a 'present' of a resolution to the problems happening quickly because the OEM had to resolve these due to their own detrimental financial situation. The OEM had experienced financial losses of over £400 million in the 2021-22 financial year. A further aspect of this was for subsidiary managers to emphasise to the divisional HQ the projections of increasing

semiconductor capacity from 2022, including the €43 billion of investment being mobilised by the EU in the future (European Commission, 2022).

Nonetheless, past experiences of dealing with short term production network delays and resulting unpredictable customer demands, were weaved into the thinking and actions of managers as they sought to construct a reality of uncertainties, and need for greater risk management in the immediate events with the OEM and negotiations with the divisional HQ. The most notable event was that of the 2011 Fukushima earthquake, which effected the supply of key components, as well as the shortages of silicon wafer production impacting other parts of the supply chain for OEM customers. The impact of this event was for Alpha to place a greater onus on understanding the operational situation of their suppliers who had been effected, as well as seeking more information from the OEM on their anticipated demands.

While these initiatives were still in operation at the time of Covid, their importance grew substantially as they were weaved into the actual occasions of day-to-day decision making that was taking place at Alpha. New actual occasions of increased communications with suppliers in southeast Asia and the OEM customer in England took place (and thus more intensive spacetime relations). This involved buyers, supply chain managers and logistics managers all working through past experiences of addressing supply chain issues such as that arising from the 2011 Fukushima earthquake.

Temporalities and capabilities of production network management

The events experienced by Alpha are also evident at other Welsh first tier suppliers, particularly characterising everyday events where they had limited knowledge and data on the operational situation of third tier suppliers, and no knowledge on the latter's suppliers. In the past, supply chain managers had constructed contemporary realities, based on their prehensions of past experiences, where no substantive issues had been encountered and that existing risk management systems had not been

invalidated by realworld events. These were therefore socially constructed realities of managers not requiring in-depth data from suppliers on their supply chains. Yet, the events of Covid reconfigured the importance of these past experiences.

Whereas issues such as the cost and quality of supplier components are significant for firms, these were being accompanied by the increasing strategic importance of maintaining global supply chain flows within the present, and which relates to cost issues. Firms increasingly recognise the significance of suppliers in mediating risks (Golgeci et al., 2020). This is most notable with the growing importance of delivery lead-in times and the efficiency of supplier delivery, meaning that firms are more concerned with understanding the contemporary situation of their suppliers, with the events of interaction and deliberation being prehended through data on both the present and their past performance in delivery.

Supply chain buyers and logistics managers weaved-in the greater importance of present and future requirements to ensure no major disruptions to supply chains. This included new data requirements and temporalities from suppliers on their stock levels, whether they were at or able to operate at full capacity, and if they had requisite supplier arrangements to ensure supply was not disrupted, particularly for components requiring semiconductors. The culmination of this was the creation of new actual occasions of experience, representing change, and involving the continual transfer of production and supply data from suppliers to the Welsh firms. The purpose of this was to construct an accepted reality of far more intensive and interwoven temporalities and spacetime relations.

Such processes worked through the development of new capabilities in the form of monitoring technologies geared towards risk management. This involved temporalities and spacetimes that were developed for ensuring supply chain relations and delivery in the face of risks and upheavals in the future, and the ability to monitor and manage in the present. For many firms it became a case of real-time monitoring and micro-management of the transportation of supplies from overseas to Wales.

Investment in new monitoring software that utilises algorithms and the internet of things took place, making it possible to create new actual occasions and events of real-time co-existence between suppliers and Welsh customers. This was evident for supplier arrangements based on Delivery Duty Paid (where the supplier has responsibility), as well as the growth of components being the responsibility of Welsh firms once they are placed on to ships in Southeast Asia, or leave supplier premises in mainland Europe (Delivery Duty Unpaid). The most common process has involved the training of their logistics planners so they have greater knowledge of the transportation of goods and the potential issues that can arise, and investment in new monitoring software.

One particular example is that of Beta, which produces components for an OEM in the UK and several in the EU. With c.40% of components coming from suppliers in Southeast Asia, as well as 20% from Eastern Europe, the firm had long worked through Delivery Duty Paid (DDP) arrangements. The past experiences of the firm had been one of many suppliers competing for contracts, and with this came DDP benefits from these suppliers. With Covid, these past experiences were partly replaced by a different relationship as Beta was far more focused on the risk management of supply chain transportation, irrespective of whether there were DDP or DDU arrangements. In one instance, there was a prehension of various processes leading to events of considerable uncertainty. Key Chinese suppliers went into multiple lockdowns during the Covid period. Lead-in times for products to reach the firm became intermittent and increased in time to around three months, including a 50 day transit from China by sea. During this period, the main production network events of Beta focused on being able to establish and maintain ‘communication’ with suppliers, since multiple lockdowns meant managers and workers were unable to communicate for weeks. As the Purchasing Manager notes:

“The challenge was just trying to get communication with far Eastern suppliers. Certainly China anyway, because it was in lockdown instantly and repeatedly. Everything was closed off to you. It took weeks sometimes to even get any communication coming through. You know, when the government turned and said you got to stay indoors, you can't do anything then and they couldn't talk to us.” (Author's interview).

At the same time, Beta experienced a substantial increase in monthly transport costs, from £20K in early 2020 to £75k in early 2022. This was accompanied by an increasing number of delays from Southeast Asian suppliers as they sought to fulfil a number of existing orders, whilst experiencing their own supply problems for resources.

These events produced important processes constituting the prehension of negotiations with suppliers to develop new risk management arrangements. During negotiation events, Beta argued that the impact of Covid represented a break from a past of low cost transportation and optimum delivery times, and required new monitoring of delivery arrangements that would embed certainty into a present in which the firm would get the components relatively on time, and that this would ensure a long term future trading relationship. Critical to these negotiation events were Beta managers socially constructing a reality amplifying contemporary and potential future disruptions to supplies. Notable elements to these negotiations include managers emphasising temporalities of how there was no immediate end to the disruption caused by Covid (e.g. lower levels of key components supply such as semiconductors), and that past stable production and supply chains (e.g. without lockdowns disrupting production of supplies) were now historical.

Beta managers argued in the negotiations that production relations had to be closer through real-time monitoring of production and transit. The actual occasions of production at these sites, in both Southeast Asia and mainland Europe, have become imbricated through socially proximate spacetime relations of new monitoring arrangements using Magaya Digital Freight Platform software. This has led to a situation where the managing director notes that:

“We’re micro-managing supplies now. In the past, we’d only be interested when the boat arrived. Now, what we do is constantly check on the website to make sure the boat is in the right position, when the boat’s ready to dock, where it is on the motorway etc. So that

has been a learning experience. We've had to modify our processes. As soon as it leaves China it is ours so we have to manage it." (Author's interview)

Negotiating and transforming global production networks

As part of risk management strategies, firms have reconfigured their procurement procedures to ensure they can meet production requirements in the present by moving to a dual or multi-sourcing arrangement. This represents an important process for certain firms in that it involves engaging the issue of reliability/resilience versus efficiency (Golgeci et al., 2020). One particular example is a Welsh subsidiary involved in the production of automotive components, termed Gamma. The firm employs around 300 workers, forming part of a Japanese global corporation with profits of over £5 billion in 2019-20 before Covid, and with the subsidiary serving the European market. Leading up to Covid, there had already been close dialogue between the firm and suppliers in relation to risk assessments around the potential disruptive impacts of Brexit. It was during this experience of deliberation that it became clear to the firm that there was a need for multi-sourcing, but Covid considerably accelerated the necessity for action in order to increase risk management and safeguard against cost increases from insufficient supplies.

Gamma sought to reduce the scope and time taken for the approval process and technical due diligence tests for a new mainland European supplier, which were historically produced in response to previous events such as encountering unreliable suppliers. The past development of the Japanese corporation's extensive due diligence tests and approval process provided the prehensions guiding the supply chain management events of subsidiaries such as Gamma. This produced events and temporalities of deliberation with potential suppliers and the actual decision-making process that took up to two years. Yet, the 'present' of immediate production network disruption and blockages, and increasing extra costs, marginalised the importance of the considerable breadth of these tests in the events experienced by Gamma managers as they sought to address supply chains delays.

Deliberations took place with the corporate HQ supply chain managers in September 2021. The negotiations were one of initial senior corporate management prehending the events through adherence to the historically produced procedures for selecting suppliers, which for Gamma's management reflected the former's experiences in supply chain management. Their social realities were one of values and norms of strict selection procedures, because of the strong adherence to lean production and just-in-time principles relying on confidence in suppliers to ensure certainties and long term working. In contrast, Gamma created temporalities for influencing the corporation's policy of due diligence tests for suppliers in these meetings. Gamma's managers presented the impacts on production, costs and turnover in the present and their projection into the future, and that historically produced procedures were no longer relevant for the immediate future.

An aspect of this was to socially construct a reality of their desperation at the uneven supply of material for their plastic injection moulding activities from an existing supplier in mainland Europe. This unevenness was conveyed as having to reduce the production of certain products whilst waiting for supplies at certain points, and where in these events Gamma was powerless to address this issue. This was accompanied by managers socially constructing a future in these meetings that could not be completely quantified, as it was unclear at the time how long Covid would last. A past of in-depth and long term corporate due diligence tests for suppliers was therefore being overwhelmed by the uncertainties of the present and future.

One aspect of this, for instance, was for Gamma to socially construct a reality of between 4-12 week delays in the supply of plastics, which would hinder production and therefore increase costs. Gamma's management stated in these meetings that it was unclear how long these potential delays would last given the unpredictability of future lockdowns. The prehension of data by Gamma in these meetings was based on the timeframes of shortages that had occurred recently, but these were in large measure estimates because there was no past data to utilise. Rather than avoid a discussion of the validity of

these estimates and their temporalities in these meetings, Gamma's management instead explicated how these were estimates because of the considerable uncertainties of the production environment, and requiring the marginalisation of strict due diligence tests. These events of negotiation were characterised by the prehension of experiences of an immediate past and existing present of unique uncertainties.

The temporalities of the issues presented by Gamma led to the subsidiary being given the authority to condense certain "non-predictable stages in the approval process that might take some time to complete", and then "pulling the material in before the agreement was signed, which is not the normal way of doing things because of all our procedures" (Procurement Manager, author's interview). The much broader temporalities and spacetimes of the approval process, which encompasses multiple datasets and tests (e.g. legal obligations), were therefore condensed into far fewer and more limited events. Subsequent events of judging and selecting suppliers therefore included a less extensive focus on any litigations that potential suppliers have been involved in across the globe, and checking complaints, negative reviews, and workforce and workplace issues in the countries that suppliers operate in. The firm subsequently moved to three suppliers (one UK and two EU based) of ABS materials for two products. Complexities of the present thus led to the inclusion of future priorities on maintaining supplies and managing risks.

Difficulties of enacting production network changes

Welsh firms sought to develop closer links with suppliers and customers that are located in English regions, mainland Europe and Southeast Asia, largely as part of their risk management strategies and to ensure a continuity of supplies as a way of preventing cost increases in the present and future. For many firm managers it was a case of seeking to be pragmatic and more compromising with suppliers and customers, where temporalities of having to deal with present complexities are interwoven with maintaining future production relations.

While developing trust and mutuality is a desire for firms, it has to be built-up over time with long term suppliers (Murphy, 2012). Despite efforts at developing more empathetic relations, in many cases the relations are historically constituted as arms-length, characterised more by market transactions rather than the development of social relations of trust. This meant that efforts to mediate Covid through stronger social relations with suppliers has been hampered in the present, and subsequently effected Covid responses. A notable aspect of this is the nature of relations that have developed since the Brexit vote, and thus an immediate past influenced the nature of present and future relations.

An example is that of Delta, which is a Welsh manufacturer of bespoke automotive components. As a first-tier supplier, the firm serves a global market for bespoke orders rather than a standard product. The plant in South Wales produces the final component through plastic injection moldings, machine tooling, and the final assembly tasks but involves many components from suppliers in mainland Europe and Southeast Asia. The impact of COVID, and how it was mediated through deliberative events, was prehended through the experiences of Brexit. Before Brexit, the firm had European suppliers that were working on the basis DDP arrangements, where the seller is responsible for delivery and costs. At the start of the COVID period, Delta had various meetings with mainland European suppliers to ensure immediate supplies, but these events were prehended by the conditions and past negotiations surrounding Brexit.

Consideration of trading relations between Delta and suppliers, before and since the final Brexit agreement, involved discussions on who is paying for future customs duties. Mainland European suppliers asked Delta to internalize the costs of the delivery duties (DDU), where previously it was the responsibility of the supplier. Even where Delta had extensive social relations with its mainland European suppliers, these relations became far more challenging, a situation that was further compounded by COVID (Fuller 2021b). In meetings to ensure supplies, it was difficult for both Delta

and suppliers to comprehend the temporalities of COVID because of the considerable uncertainties around the length of lockdowns elsewhere and the impacts on production networks. There was a further reinforcement of DDU responsibilities for Delta, despite its efforts for more flexible arrangements to also encompass DDP. The financial pressure on Delta subsequently increased in the short term, compounded by the requirement for products from certain suppliers, with these processes prehending subsequent meetings during the COVID period. The competitive environment and efforts of suppliers to mediate the upheaval caused by Brexit and COVID in the present therefore reduced the desire to produce present and future relations of trust and long-term contracts. While Delta and other Welsh firms have been negotiating with their suppliers during this period, the uncertainties and upheavals being experienced means there was uneven commitment to closer production relations by suppliers.

These negotiation events with suppliers are also created through prehensions of the inability of “trying to physicalize [production] back to the UK and Europe” (Managing Director, author’s interview). Delta managers describe these as deliberative events where both they and suppliers understand a reality of dependence. A social reality is constructed in these events prehended by experiences of Delta depending on Southeast Asian suppliers because of an absence of suitable suppliers in the UK, which lack technological capabilities and requisite workforce skills (see also Moradlou et al. 2021). Approximately 35 percent of the value of its products in 2022 derived from Southeast Asian suppliers. This included electronic components (e.g., displays) involving specialist suppliers in Hong Kong, while sourcing of prototypes and very bespoke orders relied on a Taiwanese firm with operations in China. The materialities of dependence on Chinese suppliers, in the sense of both low cost and more developed components when there are no viable alternatives, leads to temporalities of present and future necessity in the absence of alternatives. They also form the prehensions characterizing negotiation events, which for Delta has meant reinforcing existing relations with suppliers.

CONCLUSION

Utilising process philosophy, this paper demonstrates that the weaving together of the past, present and future in actual occasions is intrinsic to the social construction of reality by actors as they mediate the impacts of Covid. Temporalities and actions were geared towards reducing and maintaining costs, and managing risks, rather than the extensive development of new capabilities. The present events of everyday mediation became critical, but where these events are produced through prehensions of various historically constituted processes. There are important implications for other regions in that organisations should provide immediate policy interventions to maintain and reduce costs, and help manage production network risks. Understanding the nature of firms is critical, particularly in terms of how they socially construct reality and temporalities, but where there is an appreciation of the continuous ‘becoming’ of firms in constantly emergent events.

There are limitations to the study in the sense that it focuses on a specific recent event, rather than a historically constituted set of crisis tendencies. However, a process philosophy perspective provides key conceptual tools in which to examine the latter, not least in terms of the ‘conjunctive’ approach (see Cloutier and Langley, 2020). From this, there are broader conceptual implications for economic geography. As explicated in the social construction of responses to Covid by firms, human actors sense a particular interpretation of reality within their experiences of the actual occasions, and where they create representations to understand and project this reality. The consequences of such an approach for economic geography are, firstly, that the past, present and future are in constant transition and constitute the actual occasions of experience of actors. While evolutionary thinking takes account of the historical constitution of actors and regions, a process perspective moves beyond this by explicating the importance of understanding the constant ‘becoming’ of actors that are interwoven with events encompassing the past, present and future. This includes understanding how the examination of the economic trajectories of regions requires appreciation of the ‘why’ and ‘how’ of the temporalities of

actors. An important aspect of this is how the role of the past, present and future are interpreted, given meaning and then organised by actors (Hernes, 2021). Such an approach is congruent with economic geography accounts explicating the significance of agency, but differs in that agency is treated in dynamic terms and imbricated with an emergent environment.

Secondly, the analysis of Welsh firms elucidates how actors create spacetimes in their production network relations with suppliers. The actual occasions, and their nexus configuration through events, are sites where processes of experience produce spacetime. In such processes, spatialities and temporalities are produced by actors in relations with others. Through such a perspective, and corresponding to the arguments of Merriman (2011), economic geography accounts can place greater emphasis on how actors socially construct their realities and interact with other actors and processes to produce, respond to, and interact with different spacetimes in the perennial events of reality. This does not mean the marginalisation of important spatial concepts such as territories, scales and networks within economic geography. A process perspective of spacetime incorporates an understanding that relational events and the processes and actors constituting these, generate, reproduce and change the constantly emergent and socially produced spatial relations of territories, scales and networks. Such an approach is congruent with Massey's (2005) argument that space is 'constituted through interactions', 'coexisting heterogeneity' and is 'always in the process of being made...[and] never finished' (9). This suggests a need for greater conceptual focus on dynamic and emergent actual occasions of spacetimes that produce scales, territories and networks through relations.

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