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Digital Entrepreneurship in Agrifood Business: A Resource Bricolage Perspective

Abstract

Purpose: The aim of this research is to investigate entrepreneurial opportunities through digital technology among agrifood businesses. Specifically, the research uses resource bricolage theory to evaluate the various activities that agrifood businesses conduct through digital technology, and whether these businesses realise their full potential from these activities.

Design/methodology/approach: Data is gathered from 22 semi-structured interviews with representatives of small agrifood businesses. Maximum variation sampling was used to ensure that respondents were representative of different types of agrifood businesses across the food supply chain. Interview data was analysed through thematic analysis.

Findings: Agrifood businesses engage in a range of activities through digital technology, however, findings point to a continuum of different attitudes among respondents towards the adoption of digital technology, ranging from passive to proactive attitudes. Notable themes from the research identified efficiency and productivity, usability, marketing, and connectivity as issues in the adoption of digital technology by agrifood businesses. However, these businesses were less likely to engage in cutting-edge technology activities.

Originality: This research contributes to emerging research on digital entrepreneurship, but particularly on digital entrepreneurship in the agrifood sector. This builds on existing debates relating to the passive nature of agrifood businesses towards growth opportunities. The use of research bricolage is also a novel theoretical approach to research on this topic. The development of a digital technology adoption continuum provides businesses and policymakers with a deeper understanding of how digital entrepreneurship opportunities can be harnessed.

Keywords: Digital entrepreneurship, agrifood, resource bricolage, technology

1. Introduction

Digital entrepreneurship has seen increasing research in the last decade, covering a range of issues, including digital business models in various contexts (cf. Dutot & Van Horne, 2015; Ojala, 2016; Troxler & Wolf, 2017), opportunities in the sharing economy (cf. Richter et al., 2017), and challenges and opportunities from the implementation of digital technology in entrepreneurial processes (cf. Nambisan, 2017). Digital entrepreneurship is the intersection of digital technologies and entrepreneurship (Nambisan, 2017) and a phenomenon which developed through technological assets, notably the internet, and information and communication technology (Le Dinh et al., 2018). As an emerging field of research, further exploration of digital entrepreneurship issues is necessary across various settings. This is true for the agrifood sector, as it has faced many challenges in recent times as global crises, such as the Covid-19 pandemic, the war in Ukraine and international economic instability, have underlined the interdependence of countries in global supply chains, and the impacts that these have on activities in the agrifood sector (Apostolopoulos et al., 2021). Thus, this paper explores entrepreneurial opportunities and challenges through digital technology in the agrifood sector, aligning with the Hull et al. (2007) notion of digital entrepreneurship, as entrepreneurship where some or all of what would be physical in a traditional new venture has been digitised.

While previous studies have researched digital entrepreneurship in the food and drink industry (cf. Annosi et al., 2020; Cannas, 2021; Olan et al., 2022), this study differs due to its focus on agrifood producing businesses across all stages of the food supply chain, from raw ingredients to finished products. Agrifood businesses are chosen because the food and drink industry represents an important sector, but one which has faced many challenges in recent times (Apostolopoulos et al., 2021). Previous research has stated that the businesses in the agrifood sector are less proactive in seeking growth opportunities (Bowen & Morris, 2019), therefore considering the opportunities that have been lauded in digital entrepreneurship (cf. Nambisan, 2017), it would be necessary to explore how digital technology can develop entrepreneurial opportunities in agrifood businesses. As well as addressing gaps in research on digital entrepreneurship across the agrifood sector as a whole, from farm to fork, a further contribution of this research is derived from the exploration of resource bricolage as the theoretical lens, as this allows for a deeper understanding of how the resource allocation within the agrifood sector can impact on digital entrepreneurship opportunities. The focus of this research is on agrifood SMEs in Wales, a country which has seen little research on digital entrepreneurship in this sector. The context of agrifood in Wales is particularly interesting as the average age of a farmer is over 60 years old, which can impact technology adoption (Morris et al., 2017).

This research focusses on small food producers, as these businesses face more challenges of limited resources. The aims of this research are twofold. Firstly, this research evaluates the entrepreneurial activities within agrifood businesses from digital technology through a resource bricolage lens, and secondly analyses whether agrifood businesses are realizing the full potential of digital technology in their business. As exploratory research, it is important to attain a deep understanding of how digital entrepreneurship aligns with agrifood businesses in order to identify relevant strategies for the application of digital technology in enhancing entrepreneurial opportunities. Thus, this paper undertakes semi-structured interviews with agrifood SMEs to contribute to knowledge on digital entrepreneurship by identifying specific entrepreneurial activities leveraged by digital technology within agrifood businesses, and how these activities can lead to new entrepreneurial opportunities to develop the business. Viewed through a resource bricolage lens, this considers how agribusinesses are able to make use of the digital resources at hand to develop entrepreneurial opportunities. Thus, the two research questions under investigation are: To what extent do agrifood SMEs possess relevant resources to pursue digital entrepreneurship activities?; and how are agrifood SMEs able to best make use of the resources at hand to develop digital entrepreneurship opportunities?

The paper follows the following structure: Section 2 presents a discussion of literature relating to digital entrepreneurship and introduces resource bricolage as the theoretical lens through which this research is viewed. Section 3 outlines the qualitative methodology and design of this research before the findings are documented in section 4. Thereafter, section 5 discusses the findings of this research, underlining the differing levels of digital entrepreneurship activities observed within agrifood SMEs as demonstrated through a digital technology adoption continuum, before the conclusions and implications are presented in section 6.

2. Theoretical Framework

This section discusses the literature on digital entrepreneurship, entrepreneurship relating to the agrifood sector, and resource bricolage, which is the theoretical lens through which this research is viewed.

2.1. Digital Entrepreneurship

As outlined in the introduction, digital entrepreneurship, or entrepreneurship through digital technology, has gained traction over the last decade. Defined as “the sale of digital products or services across electronic networks” (Guthrie, 2014, p. 115), digital entrepreneurship is considered “as the reconciliation of traditional entrepreneurship with the new way of creating and doing business in the digital era” (Le Dinh et al., 2018, p. 1). Research has increasingly looked at the use of digital and technology to promote entrepreneurial opportunities, increasing debates on digitally enabled entrepreneurship (Dong, 2019; Nambisan, 2017). Digital technologies are seen to advance entrepreneurship opportunities by reshaping business strategies (Cavallo et al., 2019).

The adoption of digital technologies is significant in digital entrepreneurship, where businesses, such as small and medium-sized enterprises (SMEs) can develop innovative strategies and entrepreneurial opportunities (Kraus et al., 2018; Sahut et al., 2021). While businesses rely on the knowledge, resources and capabilities at their disposal to achieve growth (Oyemomi et al., 2016), advancements in digital technology can provide entrepreneurial opportunities, which businesses need to be alert to (Kraus et al., 2018). Existing research on digital entrepreneurship underlines the opportunities that have emerged through digital technologies including additive manufacturing, blockchain, robotics, cloud computing, and big data analytics (Olan et al., 2021). Furthermore, more cutting-edge technologies, such as AI or HTC, can provide entrepreneurial opportunities in changing labour processes, developing digital business operations and advancing organisational structures, policies and practice (Jawad et al., 2021). These digital technologies provide new contexts, challenges and opportunities, thus leading to opportunities to invest in upgrading technology (Kraus et al., 2018; Nambisan, 2017). Technology adoption is evident across various stages of entrepreneurship (Cunningham et al., 2022) with digital technologies providing opportunities and solutions for businesses in the operations and decision-making processes, while simultaneously questioning the capabilities and adaptability of the business (Beliaeva et al., 2020; Ngoasong, 2018).

2.2. Entrepreneurship in the Agrifood Sector

A small body of research exists on digital entrepreneurship in the agrifood sector (cf. Annosi et al., 2020; Cannas, 2021; Olan et al., 2022), however, this remains an under-researched topic. Viewed from a dynamic capabilities perspective, Cannas (2021) states that digitalization has the power to reshape managerial and organizational structures and mindsets, which can be important in developing digital entrepreneurship opportunities. Through an fsQCA analysis, Olan et al. (2022) point to innovations in the food and drink industry through AI, which can assist decision-making, reduce financial risks, and analyse complex issues in supply chain operations. Similarly, Calandra et al. (2022) discussed the potential for Blockchain to harness long-term sustainability by promoting widespread distribution benefits to various agrifood stakeholders. Focussing on smart agriculture, the application of smart technology on the agrifood industry, Annosi et al. (2020) explore the relationship between technology usage and sustainable development. Their structured literature review points to several barriers including a lack of adequate infrastructure, incentives, knowledge to cost issues, language, and internet connectivity quality. They call for further analysis of the impact of digital entrepreneurship on the agrifood sector, which this research heeds. While such studies have explored different

country settings, there is a gap in terms of research in the UK, where the context of the agrifood sector differs from other countries, such as the high average age of farmers (Morris et al., 2017).

Sector-specific research must also consider wider characteristics of the agrifood sector. The agrifood sector has faced challenging times in recent years (Bowen & Morris, 2019). While many industries have embraced emerging technologies, agriculture has often been seen to lag behind (Barrett et al., 2010). Zuckerberg and Kennes (2017) noted that digital technology, including big data, biotechnology, drone technology and robotics were being employed in arable and dairy sectors, but that upland livestock sectors were lagging behind in technology uptake. Morris et al. (2017) discussed farm diversification, entrepreneurship and technology adoption as a response to the challenges in the sector, but discussed the high average age as a barrier to technology adoption. Furthermore, research shows that agrifood businesses tend to be passive towards growth opportunities (Bowen & Morris, 2019) and have shown limited awareness to proactively seek new technology adoption.

2.3. Research bricolage

The research is underpinned theoretically by resource bricolage, considering the ways in which small agrifood producers can leverage their resources to use digital technology to develop entrepreneurial activities within their business. Resource bricolage, derived from work by Lévi-Strauss (1967, p.17) on resource-scarce innovation processes, points to the notion of making do with ‘whatever is at hand’. Notable aspects of resource bricolage outlined by Baker and Nelson (2005, p. 336) include the combining of resources to solve problems, and the use of resources at hand which may ‘come in handy’. Resource bricolage supports businesses in overcoming a shortage of optimal resources through localised activities, (Korsgaard et al., 2021). Therefore resource bricolage can provide a suitable theoretical basis to explore digital entrepreneurship within agrifood businesses, given their predominantly rural location and resource-constrained nature.

Theoretically, previous research has focused on intersectionality theory (Dy et al., 2017), strategy (Sahut et al., 2019), or network-centric views (Srinivasan & Venkatraman, 2018), however, this research contributes to knowledge on the subject through a resource-based perspective, particularly resource bricolage, which considers the ways in which agrifood businesses can make the best of the resources at hand. It is known that smaller businesses have less access to resources, especially in peripheral areas, as the location may restrict access to important resources (Korsgaard et al., 2021). This implies that they may be constrained in their abilities to pursue digital entrepreneurship opportunities, where access to digital technology resources is limited. This research therefore aims to investigate the extent to which these businesses see opportunities and challenges in digital entrepreneurship according to their resource allocation.

3. Methodology

To meet the aims of this research in critically evaluating the digital entrepreneurship activities of agrifood businesses, this research adopts a qualitative method, using semi-structured interviews as a means of developing detailed knowledge about the activities and experiences of agrifood businesses. This method allows for a deeper understanding about the activities and strategies of the business and aligns with the aims of this research. Wales was chosen as the setting of this research since the agrifood sector plays an important role in the Welsh economy,

particularly for rural areas in Wales. Furthermore, the agrifood sector in Wales has seen growth in recent years, with an increasing reputation for quality, with 19 foods from Wales obtaining protected geographic indications (PDO, PGI or TSG status) (Welsh Government, 2023), however previous research has pointed to the average age of farmers in Wales as a barrier to technology adoption (Morris et al., 2017).

Maximum variation sampling was selected as the sampling approach in order for interview data to be representative of the different types of businesses that exist in the agrifood sector. The aim of this approach is also to obtain quality data, based on information power (Braun and Clarke, 2021). Interview respondents were selected to represent a range of agrifood businesses across the entire agrifood sector based on the activity of the business (type of food that it produces), the size of the business (micro or small), the business location, and the age of the owner manager. An overview of respondents' profiles is presented in table 1. Consequently, data was obtained from 22 interviews with owner-managers of agrifood SMEs. Within these, 11 interviews were conducted with agricultural producers (covering meat, dairy and crop production), and 11 food producers. This was done to ensure that respondents were representative of different stages of the food supply chain, ensuring that responses were captured from producers of raw ingredients, businesses that sell to retailers, and those that sell directly to customers. Business size covered micro (1-9 employees) and small businesses (10-49 employees) as this is indicative of the size of agrifood businesses, and business location aimed to ensure that all parts of Wales were sufficiently represented. The sampling also aimed to cover a range of age ranges of the owner-managers of the businesses. This is important in understanding the digital entrepreneurship intentions of the businesses.

Interviews with the business owner-managers were conducted in-person in English and recorded with the consent of participants. Questions centred on the use of digital technology within the respondents companies. Firstly questions looked at how technology is being used in the business through various stages of the food production chain, how technology contributes to business activities, how the business looks to use technology to develop the business, what resources the business possesses and how these are used to develop digital entrepreneurship opportunities, as well as exploring challenges associated with the use of digital technology. The interviews were transcribed verbatim by the researchers and coded through a process of first and second cycle coding (Miles et al., 2014). Interview data was analysed through reflexive thematic analysis (Braun and Clarke 2006; 2021), as a method of ensuring that themes are developed to represent the interview data. Coding was conducted on interview data in Microsoft word before being transferred to Microsoft Excel for further interpretation and theme development.

4. Findings

This section presents the findings of the qualitative analysis. Table 1 presents a profile of the interview respondents, distinguishing between agricultural businesses (A) and food producers (F). In line with the maximum variation sampling approach, respondents profiles include information about the type of activity of the business, the size and location of the business, as well as the age range of the owner/manager interviewee. Additional information in the table includes whether the business possesses a website and has a presence on different social media.

Table 1: Interviewees Profile

Interviewee	Activity	Size	Age	Location	Website	Facebook	Twitter	Instagram	TikTok
A1	Meat, cereals	1-9	50s	Gwent	No	No	No	No	No
A2	Meat	1-9	30s	Powys	No	Yes	No	No	No
A3	Meat	1-9	50s	Powys	No	No	No	No	No
A4	Meat, dairy	1-9	50s	Pembrokeshire	No	No	No	No	No
A5	Meat, dairy	1-9	40s	Powys	No	Yes	No	No	No
A6	Dairy	1-9	40s	Pembrokeshire	No	Yes	No	No	No
A7	Meat	1-9	30s	Ceredigion	Yes	Yes	No	No	No
A8	Meat, dairy	1-9	50s	Clwyd	No	Yes	Yes	Yes	Yes
A9	Meat, dairy	1-9	60s	Glamorgan	No	No	No	No	No
A10	Meat	1-9	60s	Ceredigion	No	No	No	No	No
A11	Meat	1-9	40s	Pembrokeshire	Yes	Yes	No	No	No
F1	Biscuits	1-9	30s	Clwyd	Yes	Yes	Yes	Yes	No
F2	Condiment	10-49	50s	Anglesey	Yes	Yes	Yes	Yes	No
F3	Sweets	1-9	30s	Gwynedd	No	Yes	Yes	No	No
F4	Food ingredients	10-49	50s	Gwynedd	Yes	Yes	No	No	No
F5	Dairy products	10-49	40s	Anglesey	Yes	Yes	Yes	Yes	No
F6	Cakes	10-49	50s	Ceredigion	Yes	Yes	Yes	Yes	No
F7	Vegetables	1-9	60s	Gwynedd	Yes	Yes	Yes	Yes	No
F8	Cakes	10-49	60s	Carmarthenshire	Yes	No	No	No	No
F9	Biscuits	1-9	40s	Powys	Yes	Yes	Yes	Yes	No
F10	Tea	1-9	40s	Powys	Yes	Yes	Yes	Yes	No
F11	Cakes	1-9	30s	Cardiff	Yes	Yes	Yes	Yes	Yes

Following the Braun and Clarke (2006) method, the thematic analysis process led to the development of 5 themes: attitude to digital technology, efficiency/productivity, usability, marketing, and connectivity. Each theme is discussed hereafter.

4.1. Attitude to digital technology

Firstly, the attitude towards digital technology varied between respondents. Overall, there was a general consensus that digital technology is both useful and necessary for agrifood businesses, regardless of the main activities of the business, however the attitudes across the different respondents could be seen across a continuum. At the lower end there were several respondents who were passive towards adoption (A1, A2, A4, A10, F8), only using basic day-to-day services, such as the internet. Conversely, at the top end of the continuum were businesses that had integrated numerous digital technology activities within their business, including for operations, productivity and marketing purposes, and also showed willingness to explore more advanced activities (A6, A8, F11). For respondent A6, the investment in digital technology was part of a long-term vision for efficiency of the farm: *“To be honest, that’s why I’ve done the robots now, because I’m 42 this year and these robots should last me 20 years. If my boys want to farm then great, we’ll carry on investing. If they don’t, then 20 years’ time I’ll be probably selling the lot”*. A8 also acknowledged that digital technology adoption was important for farming efficiencies: *“If technology can make farmer’s life easier we need to use it”*. Respondent F11 identified AI as an important aspect in the development of the business’ marketing activities: *“We are very active on social media and use Instagram a lot to promote our business, but we would like to see how we can use new technology, like AI, to help grow the business”*.

The majority of respondents were positioned between these two ends of the continuum, indicating that they engage with different digital technology, but showed differing attitudes towards their effectiveness. On the lower end businesses like A5 showed awareness of the benefits of digital technology but did not engage with it widely, only having minimal adoption: *“Technology covers everything that we do...I suppose it’s a little bit like the social media, if you’re into it, it’s good. I’m definitely not into it but I am aware that there’s good stuff out there”*. For some, age was an issue, and a disinterest in engaging with newer technology that they did not understand: *“I think you’ve probably got within the industry you’ve got a certain, you’ve got a core of people that aren’t going to engage in technology just because of their age and where they are”* (A11). Respondent A9, while in favour, expressed some hesitancy about adopting digital technology: *“Well I think it’s a good thing in the long run but be careful, that’s all I say, don’t go rushing into things”*.

4.2. Efficiency/Productivity

Within the interviews, many respondents discussed their use of digital technology as a means of developing more efficient practice, or improving the productivity of the business. This included a wide range of activities at different levels of the business, and along different stages of the food supply chain. As adopting digital technology was a major investment for some businesses there was a feeling that it was necessary to improve the operations of the business and that *“there’s no point in using technology for technology’s sake”* (A3). While some businesses only used digital technology for day-to-day activities, as expressed by those with minimal adoption, these including important activities such as research, data logging, cloud storage, and communication tools.

Among many of the agricultural businesses, the use of digital technology was seen as important for efficiency through data analysis, such as respondent A11 who used software for managing medical records for his cattle, and electronic weighing scales for his lambs: *“I can weigh 200/300 lambs in an hour and then I’ve got all the data on how fast they’re growing and the weight for, so then by looking at that data I know when to revisit that bunch of lambs to look at lambs for sale”* (A11). For respondent A8, using a smartphone means better efficiency and time management in the farm activities: *“I don’t want to be coming into the house and going on the laptop, I can do that from the yard. That calf’s been born, I can put it onto my smartphone, tweak it, it goes down to them, they send it to CTS, I get an email back to say received. That’s what you’re doing...you’re making life easier for yourself”*.

Finally, the use of digital technology provides a solution to issues with limited labour. On the agricultural side, respondent A6 pointed to the advantages of this, provided that it is financially viable: *“Robotic milkers, that’s what I’m investing in now, to help mitigate the lack of labour. Yeah, it’s all linked to efficiencies. That’s the way I look at it. It’s either got to save you money or make you money to be worth doing”*. Similarly, on the food production side, respondent F9 identified investment in technology as an important step for potential growth in the industry: *“Staffing costs push the price to non-competitive. Investment in machinery and technology is where we can make inroads into the market as we definitely have products European, Japanese and Asian markets want - but not at the price it costs to make”*.

4.3. Usability

A third theme derived from the interviews was the usability of digital technology. Positive aspects of the usability of technology were acknowledged, especially through the use of smartphones in facilitating better efficiency in activities. According to A4: *“I never thought I’d use a mobile phone but yeah, it’s very handy now. The weather is a big one for the summer. That’s on my iPad and on my phone so I can look at that whenever really, so that’s a big factor”*. Some food businesses acknowledged the benefits that digital technology has had on sales, including international sales. Respondent F7 pointed to receiving orders from customers across Europe and North America through their online shop, and receiving enquiries about orders through social media: *“Keeping in front of people is what it’s about. We get some orders through Twitter. We received an order from a kosher butcher in London, they buy some of our products and that was on Twitter on a Sunday night”*.

However, some respondents on the agricultural side acknowledged that some of the digital technology was beyond their abilities. This related partly to limited resources, such as A3, who noted that *“If you’re not careful you’re going to get swamped with data”*, but mostly related to a lack of skills in using the technology. Respondents A5 and A7 commented on the complexities of using some of the recording software: *“From my experience, some of the sheep software has been too complicated, trying to do too many things possibly, and which just confuses the whole issue”* (A7).

4.4. Marketing

The fourth theme from the interview data relates to marketing through digital technology. This was discussed more widely by food producers, as they were more likely to be linked to consumers, however, some agricultural respondents also spoke of the value of marketing through social media to their business. Respondent A8 particularly lauded the role of social media in providing information about issues relating to the agriculture sector. He even pointed out that he had brought about a change in government policy through a tweet that he’d sent: *“There is massive power in social media and a massive opportunity for many farmers to sell their produce, and...selling us as an industry”*. He believes that social media has the potential to inform consumers about the role of agriculture in providing food: *“that’s where people, I think, are missing out, that they’ve lost that, that bridge needs to be gapped from town to country, and I think social media could be that bridge”* (A8). Respondent A10 was another agricultural representative who spoke positively of social media, but noted that many people did not know how to use it effectively: *“I think for people who really understand them it’s a great asset, but you need somebody to be able to train you to do it to start”*.

The respondents’ profile in Table 1 includes information of the social media use of the respondents’ businesses. Observations from this table underline that few agricultural businesses engaged with social media or a company website. Only two businesses possessed a website, while six had a Facebook page, and only one respondent (A8) engaged with Twitter, Instagram and TikTok. For food producers this was more common. Ten of the eleven businesses possessed a company website, which was seen by some respondents as having a minimum online presence to ensure that the company was visible. Social media presence was also more widespread among food producers, with ten of the eleven respondents possessing a Facebook page, nine using Twitter, and eight using Instagram. Social media was seen as a useful means for businesses to communicate with contacts, present information about the business, and possibly to receive orders from customers: *“Facebook, email, talking to*

customers in food fairs. I get their contacts through email and I keep knocking on their door and they say, 'Oh very nice, see you later'" (F8). Only one company (F11) had a presence across all social media platforms, including TikTok. Respondent F11 expressed the value of the visual aspects of Instagram and TikTok for their business, and also acknowledged opportunities to develop new opportunities through engagement with AI: *"We are very active on social media and use Instagram a lot to promote our business, but we would like to see how we can use new technology, like AI, to help grow the business"*.

4.5. Connectivity

The final theme relates to connectivity, an issue that was discussed by most respondents as a possible barrier to effective use of digital technology. This included both broadband internet and mobile phone coverage. Respondent F2, a rural-based food producer, pointed to poor broadband access as their main hindrance: *"I would say that is a huge hindrance to us, it's a really big problem. And that's one we're lobbying hard about as well. Because we're all trying to use computers at the same time and it hangs or drops constantly and it's just not good enough"*. This was a barrier to digital technology adoption for A10: *"What's the point in going through all this when a lot of us can't get broadband anyway? Oh, but there's 96% who'll be able to, will be all right, and all the rest of it. And we said, yeah, but there's the other 4%"*.

In view of the advantages of using smartphone technology described in section 4.2, the issues that some respondents experienced with phone coverage act as a possible barrier to digital technology activities through smartphones. This was more prominent among agricultural respondents, who were located in rural areas. Connectivity was an issue for A1: *"We haven't got a very good mobile signal so some of the things are dependent on an internet connection"*. Respondent A8 lauded the value of smartphones to agricultural activity, but acknowledged that limited mobile connectivity would be a barrier for some: *"I don't think enough farmers have got smartphones. I think they're really, really important. I think we need more 4G as well. I think sometimes, we're not bad here, [but not if] you go into the next valley"*.

5. Discussion

Addressing the research questions for this study on the extent to which agrifood SMEs possess relevant resources to pursue digital entrepreneurship activities, and how agrifood SMEs are able to best make use of the resources at hand to develop digital entrepreneurship opportunities, findings underline that respondents can and do engage in digital entrepreneurship activities. However, respondents possessed differing levels of resource allocations, and therefore showed differing levels of leveraging digital entrepreneurship opportunities. Thematic analysis findings point to differing attitudes to digital technology among respondents, which had a bearing on the business making best use of their digital technology resources. Positive outcomes were noted on efficiency and productivity within agrifood processes, however, the usability of digital technology differed among respondents. Additionally, opportunities were seen in developing more effective marketing, such as through social media or new developments in AI, however, challenges were not in varied levels of connectivity.

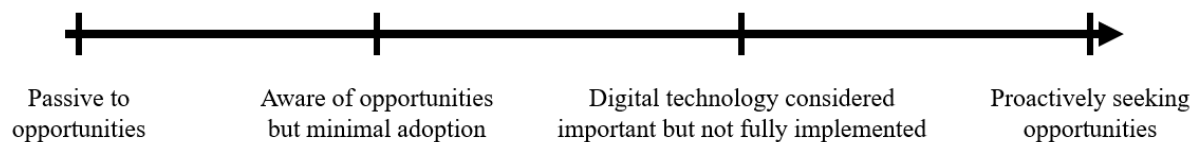
Findings outlined in the previous section underline that different respondents had differing levels of digital entrepreneurship activities, underlining the entrepreneurial opportunities that exist from digital technology (Kraus et al., 2018; Sahut et al., 2021). These varied according to the situation of the business. The findings point to three overriding issues relating to digital

entrepreneurship in agrifood businesses, namely the attitude of the business to digital technology adoption, the digital technology activities that the business engages in, and challenges to digital entrepreneurship. These issues are discussed hereafter.

5.1. Attitude to technology

As outlined in section 4.1, the research respondents expressed differing attitudes towards digital technology. This corresponds with findings of Cannas (2021) who noted the impact of digital technology on the entrepreneurial mindset. These attitudes can be further interpreted across a continuum of digital technology adoption (Figure 1). At the bottom end of the continuum are respondents who showed very little engagement with digital technology in their business, with their activities being confined to using the internet for basic day-to-day activities including conducting research and managing their financial activities. These businesses (respondents A1, A2, A4, A10, F8) could be described as *passive to opportunities* offered by digital technology. These businesses are mostly micro agricultural businesses with owner-managers aged in their 50s or 60s. Age could be a notable factor here as older age categories are often seen as less likely to seek technology adoption opportunities. This aligns with existing research that underlined that the average age of farmers in Wales is 60, which could impact on entrepreneurial activity (Morris et al., 2017). From a resource bricolage perspective (Baker & Nelson, 2005), this passivity could be explained by limited resources, due to the micro or small size of the business, but more likely due to a lack of digital technology skills and competencies by the owner/manager or within the business. This echoes research on the passive nature of agrifood owner/managers in relation to digital connectivity (Bowen & Morris, 2019)

Figure 1: Digital Technology Adoption Continuum



The second point along the continuum describes businesses that are *aware of opportunities but have minimal adoption* of digital technology. These businesses (A3, A5, A7, A9, F1, F3, F4, F9, F10) can be characterised as mainly rural-based micro enterprises, although the age of the owner/manager varies across all age ranges (30s to 60s). Thus, the ability to make use of the resources at hand could be constrained due to their rural location, where resources could be limited (Korsgaard et al., 2021). The awareness of opportunities is a positive aspect of the business, however the minimal adoption of digital technology, largely through efficiency technologies or basic social media use, could be explained by a lack of confidence or desire by the owner/manager.

The third point on the continuum refers to agrifood businesses where *digital technology is considered important but not fully implemented*. These businesses show more awareness and openness towards digital technology, with respondents (A11, F2, F5, F6, F7) using technology to enhance the efficiency and productivity of the business operations, including using smartphones to log and analyse data, using robotics and automated systems, and widespread social media engagement for information, marketing and sales. These businesses are more likely to be food producers, and small in size (10-49 employees), whose owner/manager

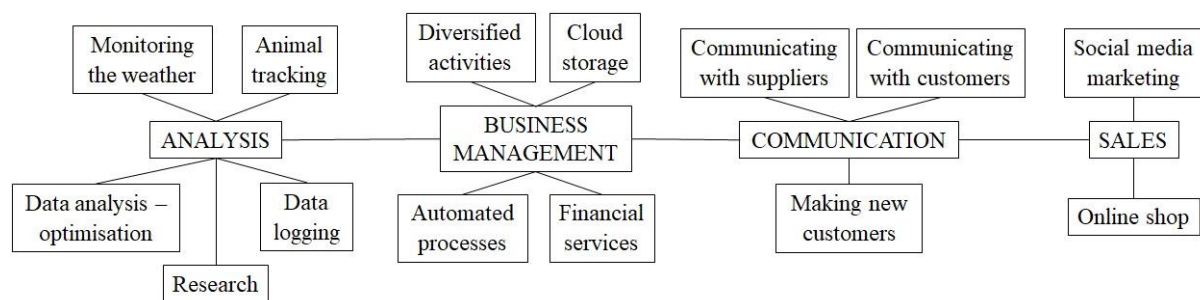
expresses more openness to exploring and investing in digital technology opportunities. As such, they are able to engage in bricolage activities by making use of the resources at hand, which may be greater than the businesses on the two previous points of the continuum, due to the larger size of the business and investment in the business by the owner/manager.

The highest point on the continuum represents businesses that are *proactively seeking opportunities* (A6, A8, F11). These business underline that despite limited resources associated with the size, location and activity of the business, the digital technology resources of the business can be leveraged in order to pursue entrepreneurship opportunities. This aligns with a desire from the owner/manager to proactively pursue these opportunities, and may require the business to invest in certain digital technology resources in order to improve the operations of the business. This is the case for A6 who has invested in automated technologies to improve efficiency. For A11, a food producer, there is widespread use of digital technology in their marketing activities, and a desire to explore opportunities through AI.

5.2. Digital technology activities

Interview respondents pointed to a range of activities that were conducted by businesses across the agrifood sector. The inclusion of different types of agrifood businesses through maximum variation sampling is important for this research, as it enables for a more comprehensive understanding of the various activities that digital technology brings to an agrifood business. A comprehensive overview of these activities is presented in the activity map in Figure 2. This categorises the types of activities that the businesses conduct, relating to analysis, management of the business, communication, and sales. In terms of analysis, respondents, especially agricultural businesses, noted their use of digital technology in logging and analysing different data in order to optimise farm operations, including weight of livestock, and tracking animals within the value chain. Research and weather monitoring were other analysis processes that were apparent, and important in ensuring efficient agricultural practice. These activities were conducted by smartphones for many respondents, or using computers, allowing for quicker and more effective practice to be developed.

Figure 2: Digital Technology Activity Map in the Agrifood Sector



Business management activities conducted through digital technology include the use of cloud storage in managing the data gathered and analysed for business operations, management of the financial services of the business, managing and evaluating automated processes, and managing diversified activities of the business. Automated processes were acknowledged by some respondents as an important means of developing efficiency in the business, especially in overcoming challenges of limited labour. This was the case for both agricultural and food producing businesses. Given the limitations of the size and scope of some agrifood businesses, some respondents engaged in diversification activities, including generating income through

tourism opportunities, renewable energy production, or developing value-added products food products in collaboration with other businesses. These activities could only be achieved through effective leveraging of the (often limited) resources of the agrifood businesses, and is an indication of their ability to display bricoleur tendencies. Communication activities related to the use of digital technology in attempting to make new customers, communicate with suppliers and existing customer. Digital technology is important in this respect through social media, as it enables businesses to better engage in dialogical conversations with contacts, which can lead to stronger relationships, opportunities for customer relationship management and co-creation. These activities were more prominent within food producers who were more likely to engage with consumers than some agricultural businesses. The same is true for sales activities, where food businesses were able to engage in various social media marketing activities, and develop opportunities for sales from customers anywhere. For some respondents this presented opportunities for sales to international markets.

The use of resources is important in the way in which these activities can be conducted because they rely on the availability of the necessary digital technology within the business, and on the capabilities of the business in using these technologies. Considering resource bricolage theory, the ability to develop these activities stems from the ability of the business to leverage the resources at hand (Baker & Nelson, 2005), and the capabilities of the business to do this would be indicative of where they are positioned on the digital technology adoption continuum (Figure 1).

While the respondents to this research display a range of digital technology activities, there is a lack of cutting-edge digital technology being used by the agrifood respondents. This includes AI or blockchain technology (Jawad et al., 2021; Olan et al., 2021). This could be indicative of the sector, as previous knowledge of the agrifood sector has shown its passive attitude towards growth opportunities (Bowen & Morris, 2019) and the high average age of farmers (Morris et al., 2017), however, some previous research has pointed to cutting-edge technology being adopted in arable farming businesses (Zuckerberg & Kennes, 2017). Consequently, this enhances the need for sector-specific research on the use of digital technology in entrepreneurship.

5.3. Digital Entrepreneurship Challenges

In addition to the opportunities that digital technology adoption brings to agrifood businesses, respondents also discussed challenges of digital entrepreneurship, aligning with findings of Annosi et al. (2020). These primarily relate to the resources and capabilities that the businesses possessed. While the opportunities from digital technology have been discussed above, the pursuit of these opportunities is only possible if the business possesses these resources, which is not always certain, as the majority of respondents to this research are located in rural areas. Rural locations are often resource-constrained meaning that it is more challenging to engage in resource bricolage activities (Korsgaard et al., 2021). Another challenge facing agrifood businesses from their location is limited connectivity. This was an issue discussed by several respondents. For some the rural location of their business had an impact on their activities as they were unable to access broadband internet or mobile signal. For other businesses this was not a barrier preventing them from leveraging entrepreneurial opportunities, but it did pose additional challenges to the effective implementation of the digital technology activities. These experiences align with existing discussions of the 'digital divide', the differences between

broadband internet and mobile connectivity between urban and rural areas. Findings of this research correspond to those of Bowen and Morris (2019), who concluded that agrifood businesses displayed passive tendencies towards growth opportunities. Here, findings indicate that connectivity issues may impact the digital technology adoption tendencies of the agrifood business, and impact on where the business may be located on the digital technology adoption continuum (Figure 1). Furthermore, as was the case with some of the respondents in this research, the resources were available, but the capabilities were lacking. This was largely due to the age of the owner/manager and a lack of experience and knowledge in using digital technology. This is not uncommon for agrifood businesses in this context, as the average age of a farmer in Wales is 60 years old (Morris et al., 2017).

6. Conclusion

This research has shone a light on the various digital entrepreneurship activities that exist in the agrifood sector. It is apparent from the findings that businesses of all types across all stages of the agrifood supply chain can and do engage in digital technology activities to support entrepreneurial opportunities in the business. However, these are seen on varying levels depending on the attitude of the business towards digital technology adoption, the characteristics of the business, and its location. Some of these aspects are interlinked, as both the characteristics of the business and its location can have an impact on the attitude towards digital technology, as smaller rural-based businesses which have limited resources and connectivity issues can display more passive tendencies towards digital technology adoption. This is in line with existing research on rural-based businesses. These attitudes were expressed in the digital technology adoption continuum, presented in Figure 1.

While this research has outlined a range of activities that agrifood businesses conduct through digital technology, as seen in Figure 2, it also underlines the digital activities that are less prominent in the sector. Agrifood respondents to this research were unlikely to engage in more cutting-edge digital activities, such as AI or blockchain, and very few respondents invested in robotics or automated services. Revisiting the aims of this research established in section 1, despite the range of activities that are evident in the agrifood sector, it can be observed that many businesses are not realising the full potential from digital technology. This could be explained by a lack of proactivity towards these opportunities, as seen by the larger number of respondents positioned on the lower end of the digital technology adoption continuum (Figure 1), with only 3 of the 22 respondents categorised as proactively seeking opportunities. Another factor for consideration is the constraints that the businesses face through limited resources and connectivity issues. This impacts on the abilities of agrifood businesses to develop resource bricolage opportunities of making use of the resources at hand. Responding to the research questions, findings imply that agrifood businesses possess a range of relevant resources in order to pursue digital entrepreneurship activities, as outlined in Figure 2. There are, however, varying attitudes towards adoption of digital technology, as outlined in Figure 1, which may be linked with the age of the owner-manager and their digital technology skills, which impact on the ability of agrifood SMEs to make best use of the resources for digital entrepreneurship opportunities.

The findings of this research provide a valuable contribution to knowledge on digital entrepreneurship, particularly the specificities of digital entrepreneurship and the influence of digital technology in the agrifood sector. This includes activities such as animal tracking and

weather monitoring in the earlier parts of the food production process, to automated production processes, cloud storage for data analysis, and social media activities in the marketing of finished food products. Knowledge about the digital technology activities adds to existing research on agrifood businesses in this context, as well as providing information about what types of digital technologies are less prominent in this sector. A critical evaluation of this research implies that the digital technology is not being fully exploited within the sector, and there is scope for developing more cutting-edge practice, such as AI activities.

The main contribution of this research is the development of the digital technology adoption continuum. It is known that different actors approach technology adoption in different ways, ranging from innovators or early adopters to laggards (Rogers, 1995), however, the continuum (Figure 1) provides distinctions between varying attitudes according to their awareness, openness and proactivity towards digital technology adoption. This can take the characteristics of the business into consideration when considering the attitude of the business towards adoption. These findings underline that respondents showed little engagement with more advanced digital technology activities, contrary to some previous literature that pointed to the role of AI or blockchain in digital entrepreneurship. A theoretical contribution is made in this research by evaluating this digital entrepreneurship through the lens of resource bricolage theory, which is a novel approach compared to existing literature, and brings a perspective of digital entrepreneurship based on the capabilities of the business. This attention on resource bricolage is important as it allows for businesses to focus on the resources at hand, and how businesses can leverage these to develop new opportunities, which is essential at times of economic uncertainty. Here, findings pointed to the ability of businesses of all types to achieve this in different ways.

Our findings provide practical implications. It gives policymakers a better understanding of how agrifood businesses in rural locations leverage digital technology capabilities for multiple activities based on their resources and environmental constraints. The digital technology adoption continuum could help businesses to evaluate their attitude to digital technology adoption through considering how this relates to the resources and capabilities of the business. Policymakers could use the continuum to better understand how business could be supported to exploit opportunities from digital technology. This could include facilitating access to cutting-edge technologies, and reducing challenges, such as by improving connectivity access.

Limitations are acknowledged in the specific scope of this research on rural-based businesses in the agrifood sector, however the findings offer valuable understandings of place-specific issues, which can have an impact on the ability of businesses to make full use of the digital technology resources at their disposal. Future research should continue to observe sector-specific characteristics of digital entrepreneurship, as this research has outlined that the agrifood sector possesses specific conditions that are different to more high-tech sectors, and therefore the types of digital technology activities differ across various sectors. Further research is needed on digital entrepreneurship more generally as this topic gains prominence. With increasing use of digital technology apparent in various types of businesses, there is a need to enhance understandings of how these activities can be optimised for better practice. An additional area for investigation is the impact that more prominent digital technology activities would have on sustainability practice.

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