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Dynamic Capabilities for Business Model Innovation in Logistics: The Role of Digital Technologies

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Abstract

The rising competition among firms necessitates new ways of doing business, especially in this digital era. This is fundamentally true of logistics companies as they strive to innovate their business models using digital technologies. Nevertheless, the dynamic competence gained by logistics firms while using digital technologies for BMI has not received sufficient research attention. Driven by the expedient research question, how do firms leverage digital technologies to develop dynamic capabilities for BMI, this study teases out the pathways to BMI by investigating how logistics companies engage digital resources to gain dynamic capabilities. Following the procedures established in Gioia methodology, we perform thematic analysis on qualitative data from the whitepapers of 20 logistics companies prominent for technology-enabled business models. Results reveal that while engaging digital technologies for their business processes, logistics businesses and their managers can sense opportunities for business expansion; seize these opportunities by mobilizing digital resources as well as reconfigure their processes to continue to take advantage of the recognized opportunities. Our results contribute to the dynamic capabilities theory by building on its core arguments to explicate the theoretical foundations of BMI development. Additionally, three propositions emerge regarding the sources of dynamic capabilities in the utilization of digital technologies by digital logistics.

Keywords: business model innovation, dynamic capabilities, digital technologies, logistics, Gioia methodology, video telematics

1. Introduction

The influx of digital technologies into global businesses has introduced significant changes to the key components of business models such as value proposition, resources, and strategies amongst others. This is because as competitive pressures continue to mount on firms, it has become expedient to innovate business models and one way of achieving this is through digitalization (Ancillai et al., 2023). There is no gainsaying the fact that digitalization births new business opportunities (Witschel et al., 2022) while also distorting old operational logics and traditional business systems. While the process of digitalization could be quite challenging for all firms, regardless of their size or nature of the industry in which they operate, its impacts are remarkable for both forward (Parhi et al., 2022; Ali et al., 2019) and reverse logistics (de Mattos & dos Santos, 2022). It is therefore expedient for logistics firms to build dynamic capabilities while adapting to the changes engendered by digitalization, as dynamic capabilities are proven enablers of digital transformation and BMI (Chirumalla, 2021).

Investigating the dynamic capabilities, BMI and digital technologies nexus remains one of the contemporary research topics in management (Bottcher et al., 2022), as technologies could induce significant changes in some business model elements of a firm or completely transform the entire business model. Meanwhile, a firm’s adoption of digital technologies is not enough to create BMI neither does it guarantee the evolution of dynamic competences, but principally, how the firm configures its existing resources as well as align its internal resources with external considerations such as social, environment and technical factors makes a lot of difference. On the one hand, BMI is successfully implemented when the firm effectively deploys accessible platforms to manage data and service discharge, thus aligning the attributes of innovation with available information technology infrastructure (Cheng & Wang, 2022). In this way, the interactions of BMI elements both at the product and organisation levels with IT infrastructure capabilities should be holistically considered when investigating the antecedents to BMI. On the other hand, rather than being viewed as a reaction to external changes, BMI could also provide firms with a means of creating new business opportunities through effectual logic (Karami et al., 2022).

Technology-driven BMI presents logistics firms with the opportunity to develop new business models tailored to meet customers' needs (Dagar et al., 2024), which is critical to logistics providers in the current digital era (Abdelkafi & Pero 2018), as they continue to seek different technical, cultural and organisational strategies for building dynamic capabilities in BMI, thus offering fertile ground for research advancement (Wang et al., 2018).

The significance of digital technologies in BMI as well as development of dynamic competences in logistics cannot be overemphasized, as adapting to changes in business models could be cumbersome with traditional methods. Hence, digital technologies such as blockchain, robotics, artificial intelligence have been deployed for BMI in the logistics industry (Tijan et al., 2019), with notable giants such as DHL, FEDex, and UPS amongst others, having made significant alterations to their business model elements. Essentially, digital technologies hold immense opportunities for BMI in logistics; for instance, the immutability, consensus mechanism and smart contracts of blockchain facilitate effective data storage and increase information use efficiency (Rejeb et al., 2021) which is necessary to improve customer satisfaction. Further, artificial intelligence, big data, robotics and cloud computing help eliminate intermediaries, address scalability and privacy concerns of transactions in digitally inclined trucking services (Alacam & Sencer, 2021).

Despite the preponderance of research on BMI and digital technologies, the pathways to achieving BMI, especially how logistics firms leverage digital technologies to transform their business models has not been sufficiently explored (Ghosh et al., 2022). More explicitly, how logistics service providers develop competences from the use of digital technologies has not received sufficient attention in the literature.

Against this realisation, this study investigates the key antecedents of BMI, by explicating the capabilities derived by firms in the process of innovating business models with digital technologies. Our research is driven by the compelling research question:

RQ: How do firms leverage digital technologies to develop dynamic capabilities for BMI?

The remaining parts of this study are thus organized; section two presents the literature review on BMI and dynamic capabilities, section three contains the methodology through which our research question is answered, section four presents the results which are subsequently discussed in section five, while the study is concluded in the last section.

2. Dynamic Capabilities and BMI in Digital Logistics

Globally, more research attention is devoted to business models and innovations resulting from changes in business models (Hock-Doepgen et al., 2021). A business model is a plan that describes how an organization creates, delivers, and captures value over short, medium and long term (Tiscini et al., 2020). It is the logic or mode of operation that underlies a business (Sahebalzamani et al., 2022). Research in business models could be stratified along three major foci; business classification, precursor of diversity in firm performance as well as a unit of innovation (Foss & Saebi, 2017). This study therefore follows the third research path which views business models as a unit of innovation. A business model must be able to create value for stakeholders while also capturing some parts of the value for the business (Lantano et al., 2022). Essentially, value creation and capture are significantly influenced by the influx of digital technologies into the business landscape, and this strengthens the realization of context-sensitive digital transformation (Muhlburger & Krumay, 2023) which in turn produces BMI.

Meanwhile, BMI is defined as the "conceptualization and implementation of new business models" (Geissdoerfer et al., 2018), or a process that intentionally alters the key components of a firm and its business logic, resulting in an overtly different business model from the current one (Metallo et al., 2018). It is considered a designed new sensitive change to the elements of a firm's business model or the architecture linking the elements (Foss & Saebi, 2017). BMI therefore results when an organization adopts a new approach or strategy to merchandizing its underlying assets (Purusottama et al., 2022). It is considered as the reorganization of the sets of activities in a company's existing business model that is novel to the product or service market in which the company operates (Paiola et al., 2022).

There is an increasing research attention on the antecedents of BMI (Zhu et al., 2022), which can be internal and external. The internal precursors of BMI are knowledge absorptive capacity, organisational agility and mindfulness of top managers (Bhatti et al., 2021), others are organisational strategy, firm capability and organisational learning (Zhu et al., 2022), while the external antecedents include environment, digital technology and strategic alliances (Zhu et al., 2022).

Indeed, the infusion of digital technologies into logistics business models has attracted increased research attention among scholars. As shown in Table 1, extant studies on BMI have benefitted from theoretical underpinnings such as Value Triangle Business Model Canvas (Tiscini et al., 2020); Behavioural Reasoning Theory (Tani et al., 2022); configuration theory (Cheng & Wang 2022); an integration of Resource-Based View and Transaction Cost Economics theories (Zheng et al., 2021), as well as dynamic capabilities, albeit, within a green innovation ecosystem settings (Chin et al., 2022), tourism (Sahebalzamani et al., 2022) and digital start-up (Zhang et al., 2022). Nevertheless, the pathway to achieving BMI within the digitalised logistic business network remains unclear and difficult to understand. However, it has been ascertained that the development of dynamic capabilities by a firm can produce BMI in traditional organisations (Inigo et al., 2017) as well as platform enterprises (Lin et al., 2020). In fact, digitalization largely results in dynamic capability gains (Li et al., 2022).

Dynamic capabilities (DC) refer to the processes and procedures embarked upon by a firm in exploiting new opportunities (Yeow et al., 2018) and it occurs through changes in business models (Sahebalzamani et al., 2022) as well as a strategic reformulation of how a given situation is conceived within an organisation (Reuter & Krauspe, 2022). While DC has been recognised as essential to firm's value proposition (Schmidt & Scaringella, 2020), three key elements of DC are germane to analysing innovations developed by firms, these include resources, strategies, and capabilities (Teece, 2018) and network capabilities have been established as germane to creating an environmentally efficient BMI (Li et al., 2023). Recent trends in information research reveal that technology embeddedness, agility, ambidexterity, and absorptive capacity are part of the dynamic capabilities that could birth BMI for a firm (Steininger et al., 2022). In this way, a firm's ability to harness and orchestrate available resources towards value capture could therefore affect BMI and its consequences (Chin et al., 2022). Against this realisation, we conjecture that when viewed through the theoretical lens of dynamic capabilities, the strategies, capabilities as well as tangible and intangible resources deployed by digitally inclined logistics firms towards achieving BMI could be better explained.

Table 1. Summary of literature

S/N	Theme	Author (s)	Theory/model	Design/ Methodology	Variables	Data collection	Analytic technique
1	The blockchain as a sustainable business model innovation	Tiscini et al., 2020.	Value Triangle Business Model Canvas.	In-depth exploratory case study.	Sustainable business model, value proposition, society, product, key operational activities, partners, capital, revenue, costs, impacts.	Semi-structure interview, annual reports, strategic plan and company website	Descriptive
2	Boundary-spanning search and business model innovation: the joint moderating effects of innovative cognitive imprinting and environmental dynamics.	Zhu et al., 2022	Business Model Innovation	Quantitative	Business model innovation, boundary spanning search extensity, boundary spanning search focus,	Survey of hi-tech enterprise managers.	Descriptive statistics, Hierarchical multiple regressions.
3	Leveraging blockchain technology for green innovation in ecosystem-based business models: A	Chin et al., 2022	Dynamic capabilities	Mixed	Ecosystem-based business model, value appropriation capability, green innovation performance, blockchain	Interviews and surveys of 119 A-shared listed Chinese firms that prioritised green innovation.	Descriptive statistics, correlation analysis and stepwise regression.

	dynamic capability of values appropriation.				technology, firm size, firm age, supply chain concentration, intangible asset ratio, total number of shares, institutional investing shareholding proportion, CEO age, overseas background.		
4	Paths toward advanced service-oriented business models: A configurational analysis of small- and medium-sized incumbent manufacturers.	Paiola et al., 2022	Business Model Innovation	Qualitative	Size and investments, customer intimacy, and external service suppliers, value proposition completeness, value prior capabilities,	Case-based investigation of 19 manufacturing firms in northern Italy.	Qualitative Comparative Analysis
5	Does Blockchain for 3D Printing Offer Opportunities for Business Model Innovation?	Klockner et al., 2020	Business model	Qualitative: Case study research	Business model opportunities, value proposition, value creation, value capture, value network.	14 experts were interviewed from 3 projects in Germany and Italy.	Descriptive
6	The spectrum of blockchain adoption for developing business model innovation.	Purusottama et al., 2022.	Business model innovation	Qualitative: Multiple case study.	Value proposition, value creation, value capture.	Archival information and in-depth interviews	Descriptiive
7	Product innovation in entrepreneurial firms: How business model design influences disruptive and adoptive innovation.	Zheng et al., 2021	Resource-based view and transaction cost economies theories	Quantitative	Product design, disruptive innovation, adoptive innovation, design novelty, business model design, product development, disruptive technological capability, firm size, firm age, founder-CEO education, founder-CEO age, founding team size, R&D, strategic alliance, incubator experience, financing,	A survey of 159 blokchain-based ventures.	Hierarchical negative binomial regression and Hierarchical OLS.

					Business model design efficiency, business model design novelty, sales growth.		
8	Antecedents and consequences of business model innovation in the IT industry	Bhatti et al., 2021	Business model innovation	Quantitative	BMI, knowledge absorptive capacity, top management mindfulness, firm size,	A survey of 172 IT firms	Structural equation modelling
9.	A Dynamic Capabilities Approach to Business Model Innovation in Times of Crisis	Sahebalzamani et al., 2022	Dynamic capabilities	Qualitative	Business model innovation, business model adaptation, entrepreneurial practices, dynamic capabilities, crisis management, resource-related practices.	Interviews of founders of 7 small companies operating in the nature-based tourism industry in Norway. Also, web search.	Thematic analysis.
10.	How companies configure digital innovation attributes for business model innovation? A configurational view	Cheng & Wang 2022.	Configuration theory	Quantitative	Digital innovation, business model innovation, user experience, value proposition, skills, improvisation, IT infrastructure capability.	A survey of 167 Chinese firms in the manufacturing and service industry.	Fuzzy-set approach by conducting qualitative comparative analysis (fsQCA)
11.	Start-Up's Road to Disruptive Innovation in the Digital Era: The Interplay Between Dynamic Capabilities and Business Model Innovation.	Zhang et al., 2022	Disruptive innovation, dynamic capabilities and digital entrepreneurship.	Qualitative: Longitudinal case study	digital technologies adoption, dynamic capabilities deployment, and business model innovation, value proposition, value creation, value capture,	Semi structured interviews, second hand information and participatory observation of managers of 'ByteDance', a Chinese tech-based firm.	Content analysis
12	Blockchain: A business model innovation analysis	Marikyan et al., 2022	Business model innovation	Qualitative	Value creation, value delivery, value capture, value networks, value configuration, risks, benefits.	No empirical data, a conceptual study	Descriptive
13	Business model innovation for circular economy and sustainability: A review of approaches	Pieroni et al., 2019	Not applicable	Qualitative: Systematic literature review	Sustainability-oriented BMI, Circular Economy-oriented BMI, system boundaries, abstraction level, variation over time,	94 academic publications were reviewed	Descriptive

14	Experimental networks for business model innovation: A way for incumbents to navigate sustainability transitions?	Engwall et al., 2021	Business model innovation	Qualitative: Case studies	Research quality, organizational domain, service domain, research domain.	Interviews to representatives of firms	Content analysis.
15.	Circular Business Model Innovation and Its Relationship With Business Performance in Brazilian Industrial Chemical Companies	Motke et al., 2022	Circular business model	Quantitative	Business model circularity, business performance, degree of innovation in circular business model, market performance, environmental performance, social performance, economic and financial performance, production performance.	A survey of 256 companies associated with the Brazilian Chemical Industry Association	Homogeneity analysis
16.	How can blockchain technology disrupt the existing business models	Nowiński & Kozma, 2017.	Business model	Qualitative: A conceptual paper	Blockchain technology, business models, disintermediation, traded goods, operational efficiency.	Literature review and desktop research; company websites, blogs, press releases.	Content analysis
17	Digital technology-enabled dynamic capabilities and their impacts on firm performance: Evidence from the COVID-19 pandemic	Li et al., 2022	Dynamic capabilities	Quantitative	Digitalization capabilities, firm performance, market capitalizing agility, operational adjustment agility,	A survey of top executives, business managers, operations managers, or IT managers of 165 Chinese manufacturing companies.	Confirmatory factor analysis and hierarchical regression.
18	Dynamic capabilities for digital transformation	Ellstrom et al., 2021	Dynamic capabilities	Qualitative	Sensing capabilities, seizing capabilities, reconfiguring capabilities, digital infrastructure, digital configuration.	Interviews and Focus Group Discussions with representatives of a firm undergoing digital transformation.	Content analysis
19	Digital strategy aligning in SMEs: A dynamic capabilities perspective	Canhoto et al., 2021	Dynamic capabilities	Qualitative	Technology use, sensing, seizing, reorganizing, strategic digital alignment, digital transformation	Semi-structured interviews with 43 SMEs across Europe	Thematic analysis

					phases (passive acceptance, connection, immersion, fusion and transformation).		
20	Dynamic capabilities in Italian leading SMEs adopting industry 4.0	Garbellano et al., 2019	Dynamic capabilities	Qualitative	Sensing, seizing, transforming,	Interviews and ethnography and secondary sources such as press releases, websites of 27 industrial SMEs which are family firms.	Content analysis.

Three fundamental groups of activities are crucial to dynamic capabilities, these include sensing opportunities, seizing opportunities and reconfiguring resource-base (Garbellano et al., 2019). The literature has further accentuated that a firm's capacity to recognise opportunities (sensing), deploy available resources to optimise opportunities towards value capture (seizing), as well as reconfigure its structure, processes, culture, and resource-base to address previously identified opportunities (reorganising), are what stimulate dynamic capabilities (Li et al., 2022; Ellstrom et al., 2021). The interaction between sensing and seizing capabilities is crucial to explaining BMI within the digital technology space (Bottcher et al., 2022). Additionally, dynamic capabilities for co-creation as well as relational capabilities are essential for recognising and utilising opportunities for BMI (De Silva et al., 2021). Opportunities in this context refers to the ability of logistics companies to render new services, train their employees, distribute knowledge as well as collaborate with their competitors (Dovbischuk, 2022), and these are crucial to the management of pressures that might arise from firms' adaptation to different stages of BMI (Best et al., 2021).

While studies have demonstrated that digital platform ecosystem promotes value creation and value proposition of BMI (Li et al., 2023), how logistics firms develop dynamic competences while seeking to innovate their business models with digital technologies has not received sufficient attention and this is the gap our study seeks to fill.

3. Methodology

To explore the pathways through which firms develop BMI from the utilization of digital technologies, this study employs qualitative methodology. Specifically, we leveraged secondary data from logistics firms listed on '*Freightech awards*' (Hryhorak et al., 2020); an annual rating of freight companies that optimize transportation services with the use of digital technologies. Freightech Awards is organized by 'Freight Waves', a leading provider of global supply chain marketing intelligence in the USA which ranks firms that have made innovations and disruptions in the logistics business as rated by top CEOs, industry leaders and investors. The rating takes into cognizance environmental measures and regulatory standards.

The rationale behind our choice of data source is that 'Freight Waves' considers firms in which digital systems constitute a core part of their business models. Inherent in traditional logistics and transportation businesses are complications such as centralized control, difficulty in reconfiguration and lack of real-time optimization (Barenji et al., 2019). A feasible solution to overcome these bottlenecks is the use of platform which enables crowd shipping and has been proven to be more ecofriendly with better environmental impacts (Rai et al., 2018). Thus, in line with our research question, we explore how logistics providers develop dynamic competences while using these digital systems to achieve BMI.

Upon the identification of the outstanding 100 logistics companies based on digital innovation, as listed on Freight awards, we proceeded to download the whitepapers of each company. Our choice of whitepapers as the principal data source was premised on the fact that whitepapers contain requisite background information about firms' business models. Moreover, it is an official document released by a company to educate readers about its operational framework, especially when there is a change in business models, perhaps due to technological addition or reorganisation of existing resources. Thus, using whitepapers as data source is like having first-hand information directly from a company, with a lot of insider information being revealed concerning the company's BMI. Out of the 100 companies listed by Freight Waves, only 20 published their whitepapers with regards to the use of digital technologies for logistics business and these 20 whitepapers constitute our data source. Table 2 summarises the information about the 20 firms whose identities are represented with letters A-T to maintain anonymity.

Table 2. Company details

S/N	Logistics firm	Year of establishment	Key digital technologies
1	A	2014	Cloud computing, data science, Transport Management System (TMS)
2	B	1985	Enterprise resource planning (ERP) system, Application Programming Interface (API).
3	C	2015	Machine learning,
4	D	2019	Autonomous driving technology, robotics
5	E	2017	Cloud computing, blockchain
6	F	2014	Blockchain
7	G	2017	Autonomous driving technology
8	H	2018	Intelligent automation
9	I	1996	Internet of things (IOT), robotics
10	J	1961	Freight matching platforms
11	K	2018	Advanced autonomous technology
12	L	2015	Blockchain, artificial intelligence (AI)
13	M	2018	Video telematics, blockchain
14	N	1996	Cloudcomputting, video telematics
15	O	2015	IOT, AI
16	P	2015	AI
17	Q	2018	Blockchain, platforms
18	R	1933	ERP
19	S	2017	Video telematics, IOT
20	T	2019	Blockchain, robotics

Following the download of the 20 whitepapers, we embarked on data cleaning by identifying the relevant sections which has to do with digital innovation and business models. The whitepapers were then imported into Nvivo 12. Following Gioia methodology (Gioia et al., 2022), we performed thematic analysis using the six-step procedure established in Braun and Clarke (2006) and has been employed in similar studies (Oguntegbe et al., 2022). First, we familiarised ourselves with the dataset by reading the contents of the whitepapers. We then conducted first order analysis (Ghezzi, 2018) through an Nvivo categorization of the information obtained from the whitepapers of the 20 logistics companies. In this process, we adhere strictly to the exact words used in the whitepapers without interference from the researchers. A total of 39 first order codes were generated from this process.

We proceeded to the second stage of our analytical procedure which consists of a more structural and rigorous refining of codes by identifying patterns based on dynamic capabilities theory. Iteration was thus maintained between our guiding theory and empirical data to refine the first order codes until data saturation was achieved. A total of 12 second order themes emanated from this second stage. The third and final stage involved an aggregation of themes by putting together similar themes which were then renamed to suit our research objectives and we identified three aggregate dimensions.

To reduce bias, we repeatedly conducted theoretical sampling by making constant comparison between theory and empirical data. Moreover, the analysis was conducted by one researcher while the results were verified by other researchers in the team, to ensure unanimity.

4. Results

Although not a direct objective of this study, noteworthy is the fact that most (75%) of the logistics companies from which we obtained our data were established in the fourth industrial revolution era (year 2011 till date), which signifies a period of rapid technological change and digitalization of business processes, with remarkable influx of disruptive technologies such as artificial intelligence, IOT, robotics and blockchain, amongst others. Notwithstanding, the remaining 25% that were founded before 2011 have also adopted notable industry 4.0 technologies to drive their businesses.

Content analysis of the downloaded whitepapers of the logistics firms reveals some interesting insights about how digital technologies help firms to develop dynamic capabilities. Basically, firms develop sensing capabilities, seizing capabilities, and restructuring capabilities from the application of digital technologies in product freight. Each of the three categories of capabilities are discussed in subsequent sections and a data structure is presented in Figure 1.

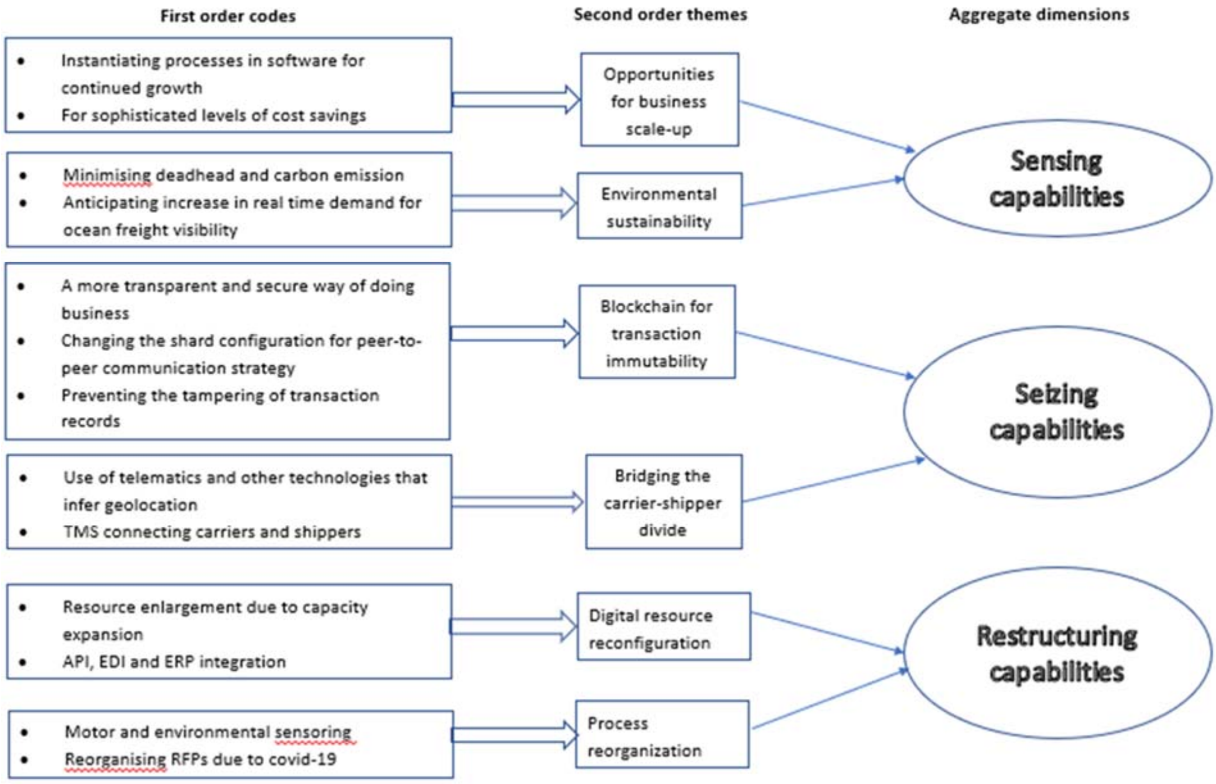

Figure 1. Data structure

4.1 Sensing Capabilities

Opportunities for business scale-up: Logistics companies engage digital technologies in sensing new opportunities for growth and business scale up. Using transport management systems, logistics companies are able to identify opportunities for business scalability through process automation. As illustrated in the data extract:

> 'We started about four years ago building onto an internal proprietary TMS, and as we were building out the foundation, the core of the system, what was so important was that we were building a TMS that made sense for Arrive. A takes A's processes and instantiates them in software so we can continue to grow and scale' (Chief Technology Officer, ArriveNow, as contained in Arrive logistics whitepaper)'.

Among the digital technologies utilised by the logistics firms under consideration are cloud computing, AI, and big data.

Moreover, logistics firms see potentials in engaging digital systems to save cost. Blockchain and AI afford logistics businesses the opportunity to save cost by engaging in logistics pooling, thereby avoiding unused transport spaces and empty travels. This is further explicated by the data sample:

> "F feels that the industry deserves a more sophisticated level of cost savings than the current RFP process can offer." (Flockfreight whitepaper, page 17)

Environmental sustainability: The use of cloud computing, data science and TMS fortifies logistics companies the with the competences to reduce carbon emissions and promote environmental sustainability. This is contained in the following data sample:

> "A works to minimize deadhead and has already saved 90 million kilograms of CO_2 emissions this year" (Source: Arrivenow whitepaper, page 18).

Additionally**,** firms capture the need for visibility in transportation especially for time-sensitive products such perishable agrifood products. This is contained in the data sample:

> F anticipates demand for real-time visibility of ocean freight volume for the second half of 2022 will continue

> to increase, with retailers needing insight into shipments of time-sensitive inventory for the holiday season (Fourkites whitepaper, page 2).

In this regard, logistics firms gain sensing capabilities when they adopt blockchain, AI, big data and other industry-specific technologies like TMS and video telematics for innovating their business models.

4.2 Seizing Capabilities

Blockchain for transaction immutability. The blockchain prevents fraudulent transactions and breach of contracts by creating a secure and tamper-proof platform for transaction and data exchange. Logistics firms therefore develop seizing competencies by utilising blockchain for making their transaction records tamper-proof. This is further supported by the following data sample:

> "The distributed ledger provides a more transparent and secure way of doing business, preventing the tampering of transaction records" (Emerge whitepaper page 13).

Logistics companies also engage blockchain and IOT for scaling-up transactions and increasing sharding and thereby gaining seizing competences for increased speed and quantity of transactions. Locus chain as a blockchain technology developed by Locus tech logistics has the capacity of executing four thousand transactions per seconds on personal computers, mobile devices or IOT. This is further exemplified in the data sample:

> "L's design goal is to provide practical Blockchain infrastructure suitable for real-world usage. We mean the goal of "real-world usage" as the capacity of transactions comparable to actual commercial transactions, like Credit Card transactions. Locus Chain's assumed capacity is at least 4,000 Transactions per Second, almost the capacity of the VISA. Also, we mean the goal of "practical" as the hardware and software requirements for the users. Locus Chain's assumed hardware base for Smart-Contract Enabled Nodes is today's regular consumer-grade PC. The requirement for transaction-only nodes is even low, as IoT-grade microdevices. In short, Locus Chain aims to be a Blockchain system with 4k-TPS capability on PC, IoT devices, and Mobile Phones" (Locus tech whitepaper, page 37).

The use of blockchain therefore provides firms with the capabilities to seize the opportunity for transaction scale-up. An essential feature of blockchain that enables this is the smart contract.

Blockchain also has a peer-to-peer configuration, and the allowable load could be estimated depending on the number of participating computers as well as the volume of data. The partitioning of data in a blockchain database belonging to logistic companies makes it easy for shards to be reconfigured or rebalanced to foster a peer-to-peer communicating strategy. Shard splitting is the action of dividing a shard into two shards while shard rebalancing is an action of moving nodes between shards.

Bridging the divide between carriers and shippers: In seeking to innovate business models, logistics firms utilize digital technologies to enhance the connection between carriers and shippers. This is contained in the following data extract:

> F is more than just an internal TMS or workflow automation initiative — it also connects "A" to its carriers and shippers (Flockfreight whitepaper, page 3).

TMS is used for tracking location of vehicles, scheduling communication with drivers, as well as video monitoring of goods and services. Some of the tools used in TMS include video monitoring devices and intelligent transport systems through cloud computing and video telematics. The use of such digital equipment by firms leads to the development of technical capability for improved carrier-shipper connection.

Having identified the need to match visibility demands as an opportunity for the use of digital technologies, managers are able to seize this opportunity by also engaging digital technologies in revolutionising their business models, such as the use of video telematics to identify areas where drivers need further skill acquisition and improve the overall transport efficiency by identifying routes that are congested or dangerous for travelling. The following data extract further illustrates:

> "Data captured by video telematics systems also gives fleet managers greater insight into their operations to improve overall fleet safety and efficiency. For example, data can be used to help fleet managers identify areas where drivers might need more training (e.g., driving in inclement weather, driving in rush hour traffic, etc.) and areas where drivers are excelling. Data can also provide for better route optimization and planning by pinpointing routes that are congested, closed-off, or dangerous" (Samsara whitepaper, page 11).

Video telematics therefore provides a strategy for gaining dynamic seizing capabilities for visibility improvement thus increasing the efficiency of connection between carriers and shippers in the freight business.

4.3 Restructuring Capabilities

To accommodate the new changes in their business models as they continue taking advantage of the identified opportunities, logistics firms deploy digital technologies and reorganise their existing resources in 4 basic ways, as subsequently discussed.

Digital resource reconfiguration. In adjustment to the increase in transaction capacity, logistics firms scale up their bandwidths to accommodate the growing frequency of communication, as well as expand their storage capacity, as reflected in the data sample:

> "From the viewpoint of computing resources, the required resources for the Locus Chain's requirements are quite clear. When the capacity grows, the required resource also grows. Transactions require bandwidths for communication, CPU times for processing, and storage for histories, or the Ledger" (Locus tech whitepaper, page 37).

Following the blockchain example of scaling up the frequency of transactions to 4000 transactions per seconds, an average transaction that hitherto requires a storage capacity of 500 bytes will now require 4000*500 (2 million) bytes otherwise known as 2MB per seconds. Thus, firms gain dynamic competences by deploying digital technologies for restructuring their existing resource base and this contributes to the development of BMI in freight business.

Another way in which logistics companies reorganize their resource is the integration of Application programming interface (API), Electronic Data Interchange (EDI) and Enterprise Resource Planning (ERP) systems. This is reflected in the following data extract:

> "Senftleber explained that enterprise shippers have made substantial investments in API and EDI integrations to their ERP systems and that those sorts of direct connections will likely always be how Arrive gets the majority of its freight from the largest shippers" (Senftleber whitepaper, page 20).

Process reorganisation. Logistics firms also reorganise their processes. For instance, aided by digital systems, request for proposals (RFPs) are restructured from yearly to quarterly rates during the covid-19 pandemic. In this way, logistics companies develop expertise for increased negotiations and higher frequency of transaction. As further supported by the data sample:

> "Coronavirus' impact on global markets showed the freight industry the benefits of quarterly RFPs. By changing the marketplace so severely, the pandemic gave carriers more power in rate negotiations" (Flockfreight whitepaper, page 9).

Empirical evidence shows that one of the biggest lessons learnt by logistics operators during the covid pandemic was the need for constant adjustment to market volatility, with shippers paying carriers fair price while offering the best value for competitive prices.

In addition, logistics companies add sensors for monitoring vehicle motion and general surroundings while on duty. This produces restructuring capabilities in truck monitoring services, as suggested by the following data sample:

> "Sensor data Devices can include motion and depth sensors, which collect information about the vehicle's immediate physical environment and movements" (Convoy whitepaper, page 16).

In the utilizing of digital technologies for innovating their business models, logistics service providers therefore develop capabilities for sensing prospects, seizing the opportunities and reconfiguring their resources to keep exploiting the new possibilities.

5. Discussions

The adoption of digital technologies has revolutionised the operational logic of logistics companies thus resulting in BMI in the process of which dynamic competencies are gained by firms and their managers. This study therefore investigates the dynamic capabilities developed by logistics service providers during the utilisation of digital technologies for BMI. Logistics companies considered in this study include firms in charge of transporting, warehousing, picking, kitting, and general movement and management of freights on behalf of their customers, which leverage digital technologies for managing their services.

Dynamic capabilities theory suggests that what matters to firms is their ability to build, integrate, adapt, and reconfigure their internal and external competencies in response to rapidly changing environment. The logistics sector in recent times is inundated with industry 4.0 technologies notable amongst which are blockchain, artificial intelligence, robotics, cloud computing and big data. Continued engagement of these technologies in handling transportation services leads to the development of three broad categories of dynamic competencies including sensing, seizing, and restructuring capabilities.

Two key sensing capabilities gained by logistics companies from the engagement of digital technologies for BMI are opportunities for business scale-up, and environmental sustainability. With TMS, logistics companies can sense new opportunities for growth and business scale-up. Additionally, sustainability is increasingly becoming an important element of business models and this concern has brought a radical shift to the operational framework of most firms (Facchini et al., 2019) especially logistics service providers. An essential bedrock of dynamic capabilities is that organizations should have sustainability-oriented values (Santa-Maria et al., 2022). Hence, logistics firms are turning to the use of digital technologies such as platforms and autonomous driving technology, to reduce carbon emissions as well as improve employee working conditions, thereby promoting environmental and social sustainability. It is on this note that we conjecture that:

> Proposition 1. Digital technologies facilitate the development of sensing competencies in logistics firms by stimulating opportunities for business scale-up and reinforcing the need for environmental sustainability.

Moreover, after identifying potential opportunities in the transportation industry, logistics companies refine their business models and operational strategies by deploying technological resources such as video telematics, blockchain IOT and big data to bridging the gap between carriers and shippers as well as for ensuring the immutability of transaction records, thereby developing seizing capabilities for visibility enhancement, increased carrier-shipper connectivity as well as resource planning. Consequently, we reason that:

> Proposition 2. Sequel to identifying and shaping new opportunities, logistics companies refine their business models by deploying technological resources for bridging the divide between carriers and shippers, thereby enhancing transaction visibility.

Further, to maintain competitiveness in the changing business environment, logistics firms reconfigure their internal and external competencies ranging from organisational culture to existing business models and resource base, and this culminates into BMI. Thus, companies restructure their digital resources and reorganise their processes. Certain resources like ERP, EDI and API which are often deployed to achieve different individual purposes are combined to enhance connection among logistics stakeholders. Aside this, resource enlargement, shard splitting and rebalancing, inclusion of motion and environmental monitoring sensors as well as collection and processing of drivers' biometric data are some of the approaches employed by logistics companies in restructuring their human and material resources to keep up with competition amidst the influx of digital technologies into the industry. Thus, we hypothesize:

> Proposition 3. Logistics firms maintain competitiveness in the dynamic technological environment by reconfiguring their resources and reorganising their existing business processes using digital technologies.

5.1 Theoretical Contributions

Our study expounds the mechanism of BMI by investigating the nexus of digital technologies, dynamic capabilities and BMI. BMI transcends mere adoption of digital technologies; it also involves the changes in business model elements as well as business processes. Thus, we explore the specific digital technology-enabled dynamic capabilities that firms gain while innovating their businesses. Extant literature has identified three categories of dynamic capabilities (sensing, seizing and reconfiguring) enabled by blockchain technology (Quayson et al., 2023) albeit within the context of circular economy. Moreover, logistics operators develop competencies when they collaborate and keep their operations flexible (Sinkovics & Roath, 2004). We illustrate that the three categories of dynamic competences are relevant in the production of BMI, thereby lending credence to the applicability of dynamic capability theory in BMI studies. Moreover, drawing from the core arguments of dynamic capability theory, our study offers novel explanations to the emergence of competitive advantage substantiated with strategies employed by firms to maintain this competitive edge.

Extant studies have proven that transport companies perform better when they acquire more resources (Wiedmer et al., 2023) amongst which is digital assets such as IOT, cloud computing, big data and other industry 4.0 technologies since they help such firms build dynamic capabilities for improved performance (Bag et al., 2020). Alignment between digital technologies and business is needed to improve firm performance. Our study builds on the findings of Luftman et al. (2017) by explicating the micro-foundations of performance enhancement through technology-business alignment. Specifically, we elucidate how the identified digital technologies transform the business model components of logistics companies and the approaches firms employ to reconfigure their resources for continued exploitation of the identified opportunities. Basically, we identified three categories of capability gains in digital logistics, including sensing, seizing, and restructuring, as well as explicate three different propositions elucidating ways in which the use of digital technologies enhance value for customers and other stakeholders in the logistics value chain.

Not many studies have attempted to investigate the dynamic capabilities evolving from the utilisation of digital technologies for BMI in the logistics industry, especially digital logistics. We therefore contribute to knowledge in this regard, by channelling a new course of thinking for gaining competitive advantage in the freight business. Our Study demonstrates that firms can leverage big data, cloud computing and IOT to identify and access external opportunities, mobilize digital resources to capture value from the identified opportunities as well as reorganise their resource structure and strategy for continued utilisation of the identified opportunities.

5.2 Managerial Implications

To make effective use of digital technologies for BMI, managers need to develop dynamic capabilities for handling digital technologies and for transforming the competence gains into BMI. We have provided empirical evidence on how firms and their managers utilise digital technologies such as video telematics and platforms to improve service delivery, thereby gaining competencies in the process of transforming the different components of their business models. In addition to the use of common technologies like TMS, ERP and API, our study advocates the engagement of blockchain, IOT, big data, cloud computing and other industry 4.0 technologies for increased interaction between shippers and carriers, pursuit of sustainability objectives as well as transaction scale-up. Moreover, managers should employ integrated use of technologies, such as EDI, API and ERP, to gain expertise and produce business innovations.

Our study further makes a case for logistics companies to take advantage of the vast opportunities made available by digital resources for revolutionising their business models thereby offering new value propositions to maintain competitive edge in the dynamic business landscape. Logistics managers are encouraged to enhance their interaction with customers and other stakeholders using ERP, TMS and freight matching platforms.

In the past, logistics firms have been heavily criticized for contributing to carbon emissions and environmental hazards as well as poor working conditions of their employees. Our results therefore demonstrate the need for logistics service providers to engage video telematics, blockchain and freight platforms for logistics pooling as well as freight monitoring thus reducing carbon emission and improving environmental and social sustainability. The advent of digital technologies thus expands the value proposition framework of logistics companies by offering stakeholders new improved value-added services which were hitherto less feasible with traditional methods. Examples of technology-enabled value propositions include visibility enhancement through technological resources such as blockchain, video telematics as well as environmental sensors. In addition, digital technologies herald a paradigm shift in the way logistics providers relate with and create value for their stakeholders. The fourth industrial revolution era has seen businesses undergone technological disruptions including the use of blockchain, cloud computing, big data and IOT for data management and this has greatly revolutionized the relational dynamics among logistics stakeholders. Digital technologies reduce intermediaries, increased frequency of interaction as well as enhanced efficiency of communication in the logistics value chain. Moreover, technologies aid logistics pooling, which refers to the networking of logistics providers to reduce empty freight spaces and maximize available transport resources, thereby fostering value capture for logistics firms. Logistics firms should therefore embrace the use of video monitoring devices and intelligent transport systems through cloud computing and video telematics

6. Conclusions

This study has viewed the pathways to BMI in the logistics sector through the lens of dynamic capabilities theory. Specifically, we have investigated how logistics firms leverage digital technologies for BMI and the dynamic competencies gained in the process. To answer our research question, we adopted an inductive approach in which qualitative data were collected from the whitepapers of the top 20 logistics companies based on digital innovation. The ranking was coordinated by "Freight Waves"; a major provider of global supply chain marketing intelligence in the USA, as rated by top CEOS, industry leaders and investors.

Following an inductive approach, data was qualitatively analysed using Gioia method. Results of empirical analysis revealed that while utilizing digital technologies to innovate their business models, logistics companies can sense opportunities for business expansion and environmental sustainability; seize these opportunities by mobilizing resource for filling the gap between carriers and shippers and making transaction records tamper-proof; as well as reconfigure their resources and reorder their business processes.

Our study was not without limitations. We have relied on publicly available information (whitepapers) for our data source, future studies can conduct interviews or survey where deliberate questions could be asked to gain better insights into the process of BMI in digital logistics by directly interacting with the practitioners. Other studies can also view the process of BMI production through the theoretical lens of resource-based view and strategic management theories to have another perspective to the emergence of competitive advantage in BMI. Moreover, this is an exploratory study which is aimed at investigating a phenomenon that has not been sufficiently researched, future studies can deepen this investigation by employing more rigorous research design and methodologies that will permit thorough investigation of how firms achieve BMI through dynamic competencies. Finally, the three research propositions emanating from this study could be empirically verified by subjecting them to quantitative analysis.

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