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An Investigation of the Impact of Digital Platforms on Value Creation – An Affordance Perspective

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Abstract

Organisations across industries are increasingly exploring and exploiting the use of digital platforms for value creation. Digital platforms create value through capitalising on multiple leverage logics (e.g., innovation leverage and transaction leverage) to achieve economies of innovation and complementarity while promoting transaction opportunities through network externalities. However, how to harness the platform leverage logics as platforms evolve and maximise platform value in both service industries and manufacturing industries is a paramount but relatively overlooked phenomenon, which motivates this research. This study thus proposes one overarching research question (RQ): *How do digital platforms enable value creation in service and manufacturing industries?* Accordingly, an interpretive case study is carried out, in which digital-born knowledge-intensive service providers and consumer product manufacturing incumbents are investigated by drawing on technology affordance theory. Affordances denote what information technology (IT) artefacts allow users to do based on their features and users' subjective interpretation of them.

To generate value by meeting the heterogenous needs of business customers, knowledge-intensive firms collaborate with them to enable product and service development, and the researcher finds four distinct innovation platform affordances pertinent in this open innovation context: organisational memory affordance, product/service development affordance, collaborative affordance, and opportunity discovery affordance. Moreover, the phases of affordance evolution in value creation are

discovered, which are exploitative affordances, affordance ambidexterity, and connected affordance synergies. The platform evolution is found to be stimulated by the driving forces of IT–business misalignments. In the case of consumer product firms, functional affordances – process management affordance, data-driven operation affordance, collaborative affordance, product development affordance – are important to stimulate digital transformation. These affordances serve as a springboard to perceiving and enacting relational affordances through firms developing a familiarity with the platform referential whole and capacity for exaptation. Relational affordances enacted through ongoing, adaptive actions would facilitate the development of corresponding organisational capabilities, which facilitate increasing the effectiveness of actualised outcomes.

This thesis contributes to the literature on several fronts. First, it extends the affordance theory. This thesis identifies the distinct affordances for each type of company based on the specific research contexts. Empirical evidence is generated to ascertain affordance evolution, and how manifold business practices can be performed to benefit from the same type of affordance. From this comes the identification of organisational capabilities that can in turn positively affect the actualised outcomes. Second, the thesis contributes to the body of literature on digital platforms in the context of value creation, shedding light on the interweaving interaction between platform evolution and market offerings in both business-to-business (B2B) and business-to-consumer (B2C) contexts. Third, by looking at how innovation platforms and internal production-oriented platforms become more open innovation platforms in different research contexts, the thesis advances the knowledge on platform evolutions, especially their early stages till the formation of platform ecosystems.

This thesis also offers implications to managers as their firms intend to use or are using digital platforms. First, managers are informed of the driving forces of the platform evolution, that is, IT–business misalignments that can serve as a signal for firms to progress their platforms into the next stage and plan in advance to cope with misalignments. Managers should develop an awareness of leveraging synergistic affordances. As affordances evolve, firms could tap into synergistic effects of affordances to reap full benefits. Meanwhile, for managers in incumbent firms, it is critical for them to foster a familiarity with digital platform whole among the general employees, so that the digital platforms, other objects (e.g., digital assets and nondigital resources), practices and the organisational identity can co-evolve and reinforce each other, which could promote the adoption of digital technologies to achieve an organisation-wide goal.

Keywords: Digital platforms, technology affordance, open innovation, market offerings, digital transformation, servitisation.

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Chen, Y., Chan, H.K., and Cai, Z. (2023), "Unravelling value creation dynamics via innovation platforms: an affordance perspective". *International Journal of Operations & Production Management*, being under first round of review.

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CHAPTER 1 INTRODUCTION

1.1 The Research Background and Problem Identification

Digital platforms, featuring layered modular IT architectures (Baldwin *et al*., 2000; Yoo *et al*., 2010), hold immense potential to reshape the ways of value creation. The strategic value benefits not only the firm itself but also all customers and the involved business partners that are part of the value-creating system (e.g., Parolini, 1999) of the particular product or service under consideration (Kähkönen and Lintukangas, 2018). Meanwhile, there is a growing trend for firms to establish digital platforms to provide solutions to their business customers, capitalising on innovation leverage and transaction leverage to achieve economies of innovation and complementarity while promoting efficient transaction opportunities (Thomas *et al*., 2014; Schermuly *et al*., 2019; Gawer, 2021). Digital platforms have been increasingly adopted by companies in service and manufacturing industries; among them, knowledge-intensive service providers and product manufacturers that are now transforming towards service business provide interesting research contexts.

Notably, knowledge-intensive or advanced services have long been connected with advanced IT (Moulaert and Djellal, 1995). Now technological developments engender a wide array of opportunities for new entrants to established service markets (Nambisan, 2017) to explore the new combinations in the coalescing sectors. The disruptive crossovers from digital technologies to service industries are fuelled by a platform logic (de Reuver *et al*., 2018). For example, an innovation platform was developed to enable patients to rehabilitate while playing video games (Shi *et al*., 2021). However, it remains theoretically and practically unclear how these service providers can explore technological innovation

through digital platforms to start and expand their business. At the same time, in a manufacturing context, the manufacturing incumbents are also establishing industrial digital platforms or evolving corporate IT platforms into more open and innovation platforms (Gawer, 2014; Svahn *et al*., 2017; Sandberg *et al*., 2020), such as the Siemens Mindsphere platform to provide comprehensive solutions to their business customers. Internet of Things (IoT) platforms enable focal firms and their business partners to enhance the platform's core with more digital functions (Markfort *et al*., 2022), offering digital services through expanding ecosystems (Eloranta and Turunen, 2016; Jovanovic *et al*., 2021).

Despite their different features of aforementioned digital platforms, they feature innovation leverage and may also include additional transaction leverage to supplement value creation based on firms' business development. As such, digital platforms studied here distinguish from platforms that prioritise transactional opportunities, such as social media and other online communities (Culnan *et al*., 2010). Given the above, the primary goal of this thesis is to investigate the role of digital platforms in enabling service and product companies to start new service business. Consequently, there emerges one overarching RQ: *How do digital platforms enable value creation in manufacturing and service industries?*

Specifically, digital-born knowledge-intensive service providers and consumer product manufacturers providing product–service bundles are chosen as the target ventures. This product service system or servitisation is not new, and it depicts the strategy of manufacturers to 'offer fuller market packages or bundles of customer-focused combinations of goods, services, support, self-service, and knowledge' (Vandermerwe and

Rada, 1988, p. 314). The positive aspect of digital-born knowledge-intensive firms is that they are known for professionalised workforce and low capital intensity (von Nordenflycht, 2010). They can directly start with innovation platforms to provide customised solutions to their clients. Given that modularity allows standardised and fast component combinations through boundary resources, such as application programming interfaces (APIs) and software development kits (SDKs) (Ghazawneh *et al*., 2012), innovation platforms usually collaborate with third parties, known as complementors to leverage external components in co-creating modularised products or services. Though such types of firms tend to enter new market segments with agility, they are also impeded by nontechnological issues such as low scale (Stubrin, 2017). Additional challenges posed to them could include the need to explore market demand for their market offerings and seek legitimacy because digital-born start-ups may initially not be well accepted, and they may enter completely new business areas with innovative practices. For digital-born ventures that serve business customers, they need the involvement of customers to complement their lack of domain knowledge, such as pain points and business scenarios faced by different types of corporate customers in diverse industries.

Relative to their digital-born counterparts, manufacturing incumbents may possess more financial resources (Sadreddin and Chan, 2022) but may face organisational inertia following the introduction of novel IT artefacts (Mikalef *et al*., 2021). For example, these incumbents are observed to have internal production platforms to achieve economies of scale and scope, and after they are infused with digitisation and open up their products or services, other types of platforms are needed to operate as a functional whole to support multiple business lines. However, without the right mindset for change, appropriate digital

routines, and structural change, incumbent firms could not reap the full benefits from their technology investment (Volberda *et al*., 2021). Because the technology per se does not generate a competitive advantage (Mata *et al*., 1995), it is necessary to consider both platforms and companies in the platform use, addressing potential challenges while exploring the different patterns of their value creation path.

To explore how platforms and companies interact to help firms with organisational goals, technology affordance theory is adopted as the overarching theory. Affordances refer to the potentials for action or opportunities offered by platforms, and they are mutually determined by platforms and organisational users (e.g., Leidner *et al*., 2018; Thapa and Sein, 2017). Platform affordances differ from platform use and capabilities because the former highlight the double dance of human (e.g., specific goals or capabilities) and technology agency, which thus can also affect the latter. Given that modern business opportunities are increasingly developed by digital affordances (Bharadwaj *et al*., 2013) and affordances are exploited to create innovation (Yoo *et al*., 2012), a technology affordance perspective that examines the possibilities for action from the interaction between both IT artefacts and users (Strong *et al*., 2014; Markus and Silver, 2008) would provide valuable insights into the roles of digital platforms.

1.2 The Research Motivations

The motivation of this thesis is driven by existing knowledge gaps. There is an underlying assumption that platform openness is needed to attract innovative contributions from third parties to increase platform value and generate strategic value involved actors in the platform ecosystem. However, value creation in the platform-related open innovation context is predominantly explored in the social media platforms and crowdsourcing

platforms, where corporate platform users access external sources of innovative ideas (Billington and Davidson, 2013; Korpeoglu *et al*., 2021), facilitate new product development (Zhan *et al*., 2020). It is thus significant to complement existing literature to examine platform-enabled value creation in the open innovation context from a platform owner's perspective concerning how they develop business and operate platforms. This gap is surprising, because value offered by platform firms, especially from unexplored fields, is closely connected with the success of platforms (Brunier *et al*., 2020).

Besides, though platform firms have evolved their platforms into more open and innovation mode, the major research line focuses on the platform development through architecture design and governance (Tiwana, 2015; Thomas *et al*., 2014) in established platforms, and on value creation and/or value capture considering decision making and the behaviours of platform owners and complementors from an ecosystem perspective (Tsujimoto *et al*., 2018). Therefore, on the one hand, it is empirically unclear about platform lifecycle, especially innovation platforms, starting from their early stages of development (Shi *et al*., 2021). On the other hand, less is known concerning how value can be created, such as innovative market offerings, as the platforms develop over time. Given that both platforms and value creation would develop over time, exploring their dynamic process would provide an enhanced understanding of how digital start-ups and servitised consumer product firms start and expand their service business.

From an affordance theory lens, as observed, most studies that draw on an affordance perspective focus on social media platforms (e.g., Karahanna *et al*., 2018; Leidner *et al*. 2018; Sæbø *et al*., 2020; Abhari *et al*., 2017; Priharsari *et al*., 2020), transaction platforms (Tan *et al*., 2016; Sutherland and Mohammad, 2018). Some scholars

interpret digitally-enabled phenomena such as digital innovation using the fundamental digital affordances, such as generativity and flexibility (e.g., Autio *et al*., 2018, Gupta and Bose, 2019). Besides, our understanding of the relationship between IT affordances and subsequent development of organisational capabilities so far remain underexplored (Steininger *et al*., 2021). The actualised affordances not only generate desired outcomes but allow firms to develop more resources and capabilities. However, though actualised digital affordances can facilitate capability development (Sadreddin and Chan, 2023), gaps exist, including 'affordance creation processes where novel affordances can emerge' (p. 68) and comparing the role of platforms across different types of firms. In other words, more research is needed to untangle the relationship between affordance actualisation and organisational capabilities. This research lacuna inspires the current study to explore more pertinent affordances in line with organisational goals, to disentangle affordance evolution and their dependencies (Strong *et al*., 2014), as well as their linkage to organisational capabilities.

1.3 Research Aims, Objectives and Research Questions

Against the backdrop of the aforementioned gaps, this thesis intends to shed light on the impact of digital platforms on value creation dynamics in both knowledge-intensive digital ventures and established consumer product manufacturers. More explicitly, this research attempts to explore what platform affordances can be perceived and actualised to enable product and service innovation to enhance the overall customer value from a process perspective. Figure 1.1 presents an overview of research topics, contents and perspectives. Overall, B2B service providers and consumer manufacturing incumbents explore distinct types of platform affordances as they venture into new business. Digital-born service

providers leverage evolved affordances when more value creation participants join the platform to develop solutions and expand business on each platform stage. Manufacturing incumbents develop organisational capabilities from actualising first-order functional affordances and second-order relational affordances, which can emerge on the basis of the former. Each type of affordances play a distinctive role in facilitating the development of critical organisational capability. Figure 1.2 shows specific RQs, which will be elaborated and addressed in Chapter Four and Chapter Five. To recognise opportunities for creating value through implementing organisational tasks and activities, identifying the affordances constitutes the first step in exploring the value of their technology investment. Thereafter, how affordances can be actualised to create value to realise specific organisational goals may differ according to specific organisational needs in different research contexts.

Figure 1.1: Overview of Research Topics, Contents and Perspectives

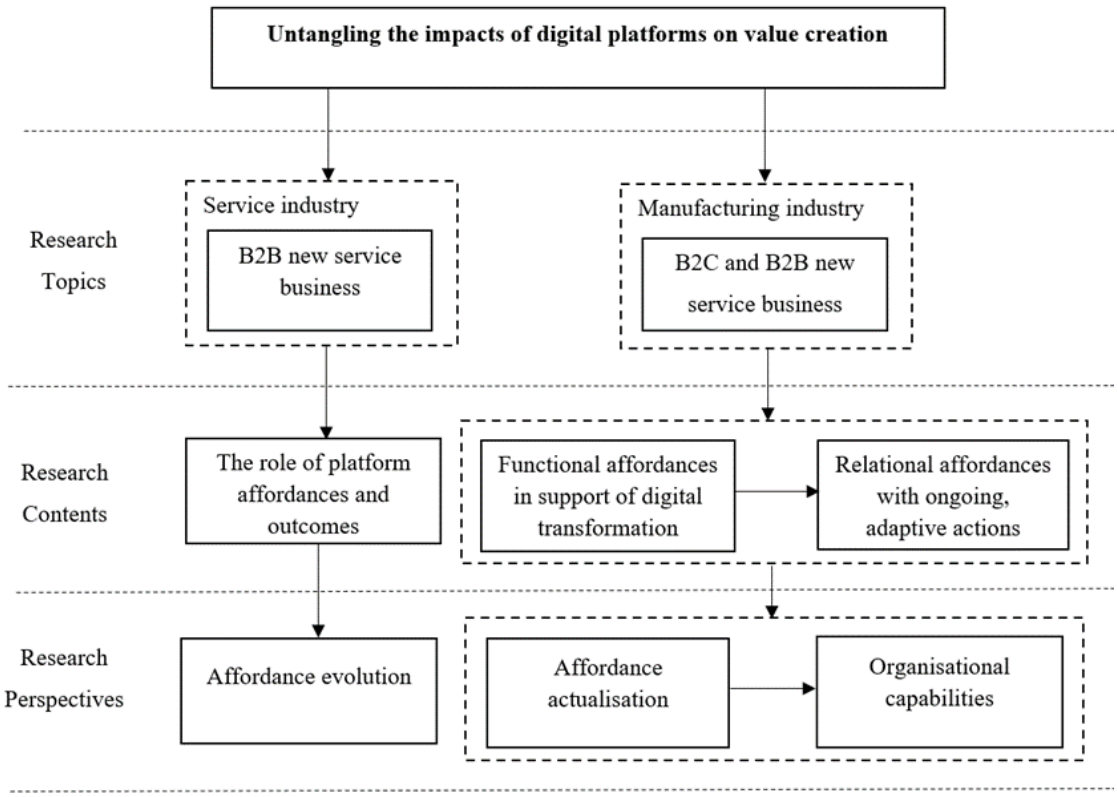
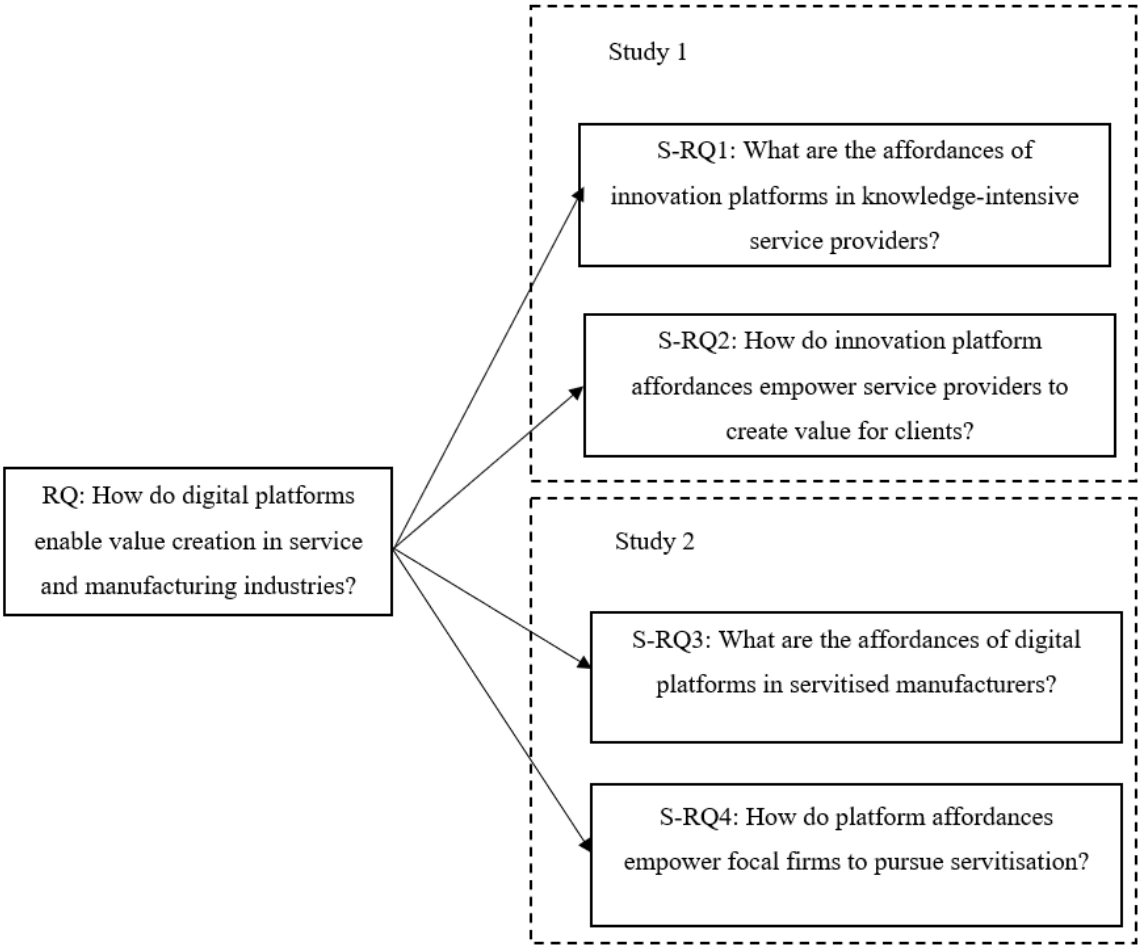


Figure 1.2: The Structure of the Research Questions



RQ1: *What are the affordances of innovation platforms in knowledge-intensive service providers?*

Answering this sub-RQ helps to identify platform affordances, which form the first step for venture creators to commercialise their idea, start the business, and ultimately grow this business. However, although service providers develop problem-solving solutions for clients, this process is often associated with complexity and information asymmetry (Aarikka-Stenroos and Jaakkola, 2012). It is hence imperative to create distinct affordances by the platform firms when they explore and exploit platforms to enable product and service development. For instance, they may pay more attention to organisational memory

affordance in an effort to provide more customised solutions in ever-expanding application scenarios. Such a difference makes the current findings hardly applicable to innovation platforms.

RQ2: *How do innovation platform affordances empower service providers to create value for clients?*

Via this sub-RQ, the researcher explores the value creation mechanism underlying the market offerings: that is, the role of specific platform affordances in value creation, and their subsequent consequences for platforms. Answering this question provides details on the development of market offerings along with the specific business goals at each stage. As such, it allows identification of the driving forces of platform development. Focusing on the early stages of platform development complements existing literature on well-established platforms, which provides researchers with opportunities to study the development of market offerings as platform firms increase openness and benefit from more open innovation mode.

RQ3: *What are the affordances of digital platforms in servitised manufacturers?*

Like the first sub-RQ, this question enables the identification of related affordances based on organisational goals by looking at functional affordances and relational affordances. Though previous researchers pointed out that functional affordances could lead to socially constructed affordances (Thapa and Sein, 2017), identified functional and relational affordances herein create opportunities to discover their relationship from a novel perspective.

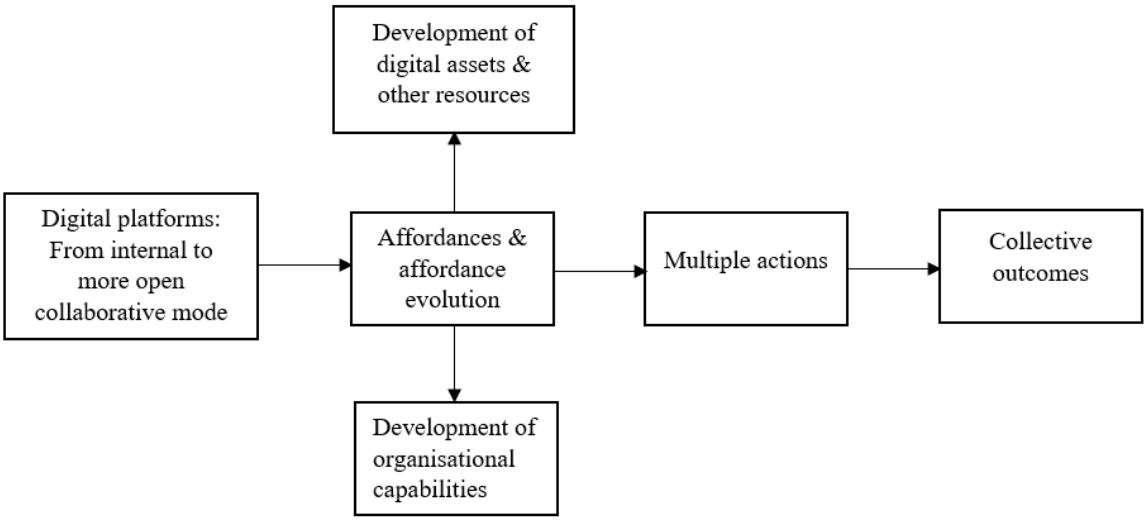
RQ4: *How do platform affordances empower manufacturing firms to pursue servitisation?*

By identifying functional affordances to support firms' digital transformation, this sub-question enables exploration of how the notions of Heideggerian thinking, 'familiarity' and 'referential whole' can be applied to interpret the emergence of relational affordances. Particular attention is paid to how the same affordances could give rise to multiple practices and subsequent actualised outcomes. The mechanism of firms performing those ongoing, adaptive actions is also revealed as exaptation – repurposing their existing resources and capabilities. Answering this question highlights that the continual affordance actualisation is required to facilitate the development of organisational capabilities to perform productive activities, thus enriching the literature that actualised affordances do not directly generate higher capabilities (Thapa and Zheng, 2019).

1.4 Conceptual Framework

Figure 1.3 integrates digital platforms, value creation and digital affordances, which is the conceptual framework of this thesis. Platform affordances emerge from the relationship between digital platforms and organisational users based on their specific business goals. During this process, on the one hand, digital assets and other resources could be developed and even secured as the platform opens up over time. On the other hand, organisational capabilities can be cultivated, which enables firms to perform the activities effectively, and this provides an alternative explanation of the variations of firm performance, other things being equal.

Figure 1.3: Conceptual Framework



1.5 Methodology

An interpretive approach based on several qualitative methods is used to answer the RQs. A case study is a typical setting for qualitative research, which combines different data collection techniques, such as interviews, archives and focus groups (Eisenhardt, 1989). Qualitative, in-depth case studies are useful to answer 'how' questions (Yin, 2018) can generate rich and context-specific insights from a process perspective, which accords with the research objective of this thesis. The case study method was employed to answer the aforementioned questions, with 12 companies in total participating in the research. Data were collected from primary and secondary sources. The first approach was formal and informal interviews with practitioners from target firms, with the result of 24 interviews conducted with digital ventures and 29 interviews with established consumer product firms. The second approach included attending online and offline workshops and accessing secondary datasets from websites. Given that many of them are listed companies, there is extensive coverage of news, information and other secondary interviews available online,

which allowed the researcher to enrich the dataset and also triangulate the tentative findings from the interviews (Carter *et al*., 2014).

After that, the thematic data analysis was applied in a combination of open coding, axial coding and theoretical coding techniques (e.g., Glaser, 1978; Urquhart *et al*., 2010; Myers, 2020). This method combined inductive and abductive logic of reasoning to seek answers to the aforementioned questions. During this process, affordance theory was adopted as the 'sensitizing device' (Klein and Myers, 1999, p. 75). The researcher identified themes and overarching dimensions after a series of comparisons and iterations, with the result of developing empirically grounded theoretical frameworks in two research contexts.

1.6 Concluding Remarks

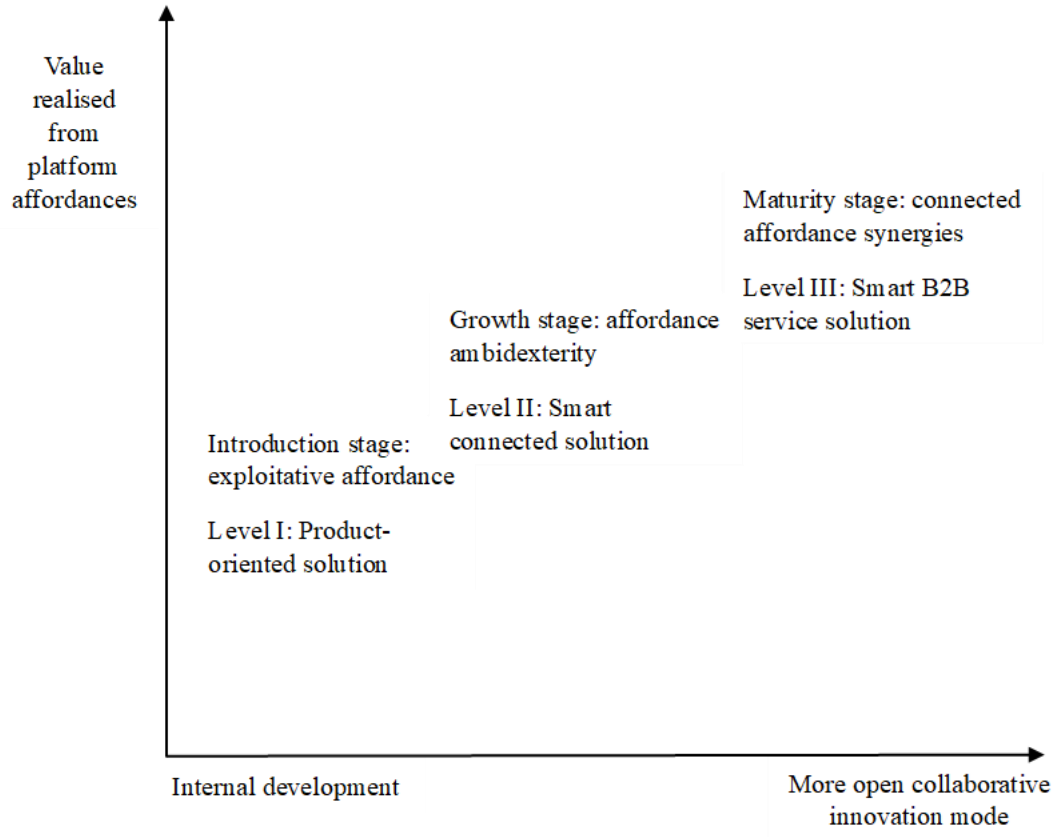
By addressing the first two questions, this thesis aimed to unlock how platform affordances are leveraged for value creation through business development in knowledge intensive service providers. The findings reveal four types of innovation platform affordances: organisational memory affordance, collaborative affordance, opportunity discovery affordance and product/service development affordance. The affordance evolution processes were mapped into phases of platform development – exploitative affordances, affordance ambidexterity and connected affordance synergies. Study 1 contributes to an in-depth understanding of how innovation platforms hosted by knowledge-intensive firms create value over time in the process of affordance evolution along with platform development. This study therefore theoretically and empirically extends the concept of affordances in innovation platforms and provides a theoretical framework that identifies four innovation platform affordances for value creation. More

importantly, the framework illustrates how affordances evolve and untangles triggers for platform development, transitioning towards more open collaborative innovation platform. By doing so, the research provides a contextualised theoretical understanding of the phenomenon and the underlying dynamics. The practical relevance of the research highlights the tactics and behaviours managers could implement to evolve innovation platforms, as well as ways firms exploit the corresponding affordances for product and service innovation to realise business goals.

Simultaneously, by answering the final two RQs, this research contributes to related literature on three fronts. First, the empirical evidence shows that digitalisation helps in developing a familiarity with digital platform holisms. That is, technology artefacts, their perceived and actualised functional affordances and the purpose of the practices to digitally transform their companies co-constitute with each other as parts of the same holism. The familiarity of such a holism further helps in perceiving and enacting relational affordances to support firms' emergent servitised business models. This finding contributes to the affordance literature on under what circumstances unexpected 'constructed' high-level relational affordances would emerge (Thapa and Sein, 2017). The second major contribution is a theoretical framework that integrates notions of affordance, familiarity, referential whole, exaptation and organisational capabilities. Examining consumer product manufacturers, this study illustrates that relational affordances can be perceived and enacted with ongoing, adaptive actions through the exaptation mechanism of repurposing their resources and capabilities, leading to three levels of digital servitisation and increased service performance. This theoretical framework enriches the understanding of the linkage between the affordance perspective and the Heideggerian perspective. Third, this study also

provides new insights into how new organisational capabilities can be formed to help firms with their changing strategic goals. Overall, the findings of Study 2 develop critical implications for digital servitisation paths in consumer product firms. A synthesised overview (see Figure 1.4) is provided to illustrate the main findings of the two studies to address the overarching research question.

Figure 1.4: Overview of two findings



1.7 Structure of This Thesis

This thesis consists of seven chapters, which will be outlined as follows to facilitate an understanding of the overall content of this research. The introduction chapter begins with the research background from which overarching questions arise. Then it moves onto the research motivation that underpins the significance of conducting the following

research based on existing literature. The research gaps, research aims, objective and specific RQs allow for a deep understanding of the overarching questions. Afterwards, the research methodology and contributions are detailed, highlighting some of the research findings. In Chapter Two, a thorough literature review is presented, which provides related research streams at the intersection of platforms and open innovation as well as the adopted theoretical perspective. The following methodology chapter provides the rationale behind the choices made regarding the research philosophy, research method, data collection approaches and analysis techniques used. The detailed research analysis and findings are presented in Chapter Four and Chapter Five. Then the discussion is elaborated in Chapter Six. The researcher synthesises relevant portion of the literature with the research findings to address the specific RQs of the thesis. In particular, the researcher thoroughly discusses the research output along with the evaluation of the relevant literature review. The final chapter is a synopsis of the thesis and includes the main contributions of the research, which is followed by the research limitations and potential future research directions.

CHAPTER 2 LITERATURE REVIEW

This chapter reviews digital platform literature and focuses on the role of digital platforms for organisations that embrace openness as a mean of expanding value creation. Based on a thorough literature review, knowledge gaps emerge, and RQs are proposed to address the gaps. The review also serves as the theoretical foundation for the design of the research process (e.g., choice of research philosophy and research method), and discussion part of this study. Equally important, this chapter aims to synthesise the related literature and develop a conceptual framework of how digital platforms enable their market offerings to have greater and ongoing value creation. This section starts with the review method and its application in the literature review process. Afterwards, it presents the results of the literature review related to four main research areas: (1) digital platform and value creation, (2) platform-enabled service innovation, (3) evolution of digital platforms and (4) theories applied to the interpret platform-enabled value creation. The following subsection introduces the proposed overarching theoretical perspective for this thesis.

2.1 Attributes of Digital Platforms

Though various definitions of digital platforms exist, digital platforms can be understood as 'a set of shared digital components (e.g., a database and the operating environment) that enables the creation of a wide range of services (e.g., applications) through boundary resources' (Sun *et al*., 2021, p. 2). In addition to the well-recognised role of contributions from complementors, the platform value is inseparable from organisational resources and capabilities developed by platform firms to serve themselves and their customers. Digital platforms are characterised by convergence and generativity (Yoo *et al*., 2012). First of all, digital platforms enable technological convergence through the

expanding value chain. Through an open technological architecture that captures information from numerous sources and enable collaboration among multiple actors, digital platforms integrate previously disconnected products, entities, and industries, therefore blurring their boundaries (Yoo *et al*., 2012). This is reflected by the modular layered architecture of digital platforms, which combine different layers and functions. For instance, physical artefacts with embedded digital technologies could widen the usage scenarios and become value-added smart products, therefore enlarging the value space for users (Henfridsson *et al*., 2018). Because digital platforms can bring together dynamic sets of parties and resources, firms can benefit from this convergence to enhance their internal operations and capacity for innovation, ultimately leading to increased profitability (Porter and Heppelmann, 2014; Nambisan *et al*., 2017; Forman and van Zeebroeck, 2019).

Meanwhile, generativity is 'a sociotechnical system where social and technical elements interact to facilitate combinatorial innovation' (Thomas and Tee, 2021, p. 256). The nature of generativity points to the significance of the digital platforms, which are inherently malleable, dynamic and able to capture the greatest value of future innovations spawned by the existing one (Ahuja *et al*., 2013). These two characteristics open up opportunities for value co-creation, because convergence necessitates the involvement of manifold parties, and generativity can realise the participation of those parties through the availability of boundary resources and opening up appropriate layers to third parties. According to Holgersson *et al*. (2022), formal platform governance matters for value creation in the ecosystem, where open innovation and modularity coincide. Modular architectures can help distinguish between closed and open components, allowing organisations to maintain control over proprietary technologies while enabling openness in

other areas. Therefore, platform firms can selectively open technologies and tools to complementors who can individually or collectively produce outputs to provide value-adding services.

2.2 Digital Platforms and Value Creation

In the review of the platform literature, Thomas *et al*. (2014) developed three types of leverage – production leverage, innovation leverage and transaction leverage − as a direct driver of value creation. Platform leverage refers to the logic of "developing shared assets, designs, and standards that can be recombined" (Thomas *et al*., 2014, p. 206) to enhance value co-creation without an increase in the consumption of additional resources. There is a strong linkage between platform literature and value creation literature. Value creation is a multifaceted, dynamic and complex notion, which points to both content (what is value?) and process (how is value generated?) (Lepak *et al*., 2007, p. 181). Generally, value is defined as a trade-off between benefits and costs, or as the quotient of benefits received versus costs incurred (de Chernatony *et al*., 2000; Walter *et al*., 2001; Ulaga, 2001). Given that both monetary and nonmonetary factors such as time and efforts should be included (de Chernatony *et al*., 2000), it is reasonably assumed that the value of an offering, value of a relationship and the value created in relationship (Forsström, 2005) would interact. Additionally, there is a large body of IT literature exploring business value of technologies (Oh and Pinsonneault, 2007; Grover *et al*., 2018), and realised value from IT investment (Davern and Kauffman, 2000; Günther *et al*., 2017). This thesis follows the work of Oh and Pinsonneault (2007) and Grover *et al*. (2018), exploring strategic value of digital platforms. Strategic value can include functional (e.g., financial performance,

market share) and/or symbolic value (e.g., positive brand image and reputation) (Grover *et al*., 2018).

When a firm provides value to customers, its value creation starts. Sirmon *et al*. (2007, p. 273) suggest that "value creation thus occurs when a firm exceeds its competitors' ability to provide solutions to customers' needs while maintaining or improving its profit margins". Particularly relevant to digital platforms, value creation can also be defined as "the process by which the capabilities of the partners are combined so that the competitive advantage of either the hybrid of one or more of the parties is improved" (Borys and Jemison, 1989, p. 241). Strategic value herein benefits not only the firm itself but also all customers and the involved business partners that are part of the value-creating system (e.g., Parolini, 1999) of the particular product or service under consideration (Kähkönen and Lintukangas, 2018).

Thomas *et al*. (2014) show that platform leverage goes hand-in-hand with platform openness that facilitate a platform firm to create an emergent ecosystem. Value co-creation within the ecosystem is inseparable from open innovation practices (Holgersson *et al*., 2022), which is particularly relevant to digital platforms that need complementary innovative contribution from third parties to increase the overall platform value. Equally, digital platforms can serve as a melting pot for open innovation. For example, the adoption of cloud computing infrastructures has led some companies to set up a shared cognitive computing platforms and cultivate a full range of technological capabilities. For instance, data mining, pattern recognition, machine vision, natural language processing and other capabilities enable resources to learn in real time, expanding and enhancing firms' technological knowledge (Urbinati *et al*., 2020). To extract more value from open

innovation, firms have moved towards a more open business model on their platforms (Cozzolino *et al*., 2018; Nucciarelli *et al*., 2017). For digital platforms, their gradual openness to third party developers is often inherently associated with the underlying business model because 'any change in openness . . . may influence the value proposition of products and services offered by a platform owner, resulting in potential changes to price and structure' (Wan *et al*., 2017, p. 9). All these changes would in turn have an impact on the attractiveness and value of the platforms to customers and business partners.

When the concept of open innovation has expanded into 'open business models', they specifically describe value creation and appropriation by 'systematically collaborating with outside partners' (Osterwalder and Pigneur, 2010, p. 109), with a multitude of actors co-creating value to realise the shared goal (Storbacka *et al*., 2012). Platform firms could be better positioned to embrace business model innovation through partnering with value co-creators (e.g., complementary service providers) and developing into a platform ecosystem. Similarly, Shi *et al*. (2021) argued that to enter a nascent market, one of the dynamic capabilities a new platform firm should develop is innovation leverage, which not only enables firms to identify, create and share the innovation assets or the core component with third-party developers for a wide range of innovation output, but also marks the starting point of platform emergence. Another example is IBM, which has advanced into new markets while consolidating its position in the existing ones by opening up the core of its Eclipse software development tool. Because other companies adapt Eclipse to their needs and open up the adaptation again to the public, the functional scope of Eclipse extends substantially beyond IBM's initial expectation and contribution. Consequently, IBM was able to sell complementary market offerings on the platform and build an

expanding ecosystem (Alexy *et al*., 2011). The aforementioned studies illustrate how the platforms develop and simultaneously create value using open business models.

In addition to business partners, customer engagement is equally crucial to getting the most out of the platform use. By exploring innovative research-driven online review platforms, Mariani and Nambisan (2021) highlighted clients could realise more strategic and transformative value from the platforms when they adopt 'open innovation' culture and make appropriate organisational changes. Given that platform-born service providers that may lack market insights, it is critically important for them to innovate their market offerings to make them more relevant in the actual use scenarios through open innovation models. In addition to third-party developers producing innovative output, it is critical for platform firms to interact with customers, research institutions or business partners to access related databases, knowledge resources and capabilities. The aforementioned efforts enable firms to innovate their market offerings to cater to specific needs of different market niches.

To summarise, although the existing studies have advanced knowledge on different types of digital platforms have reshaped the ways of creating and delivering value, how platform firms gradually open their innovation mode on platforms to integrate internal and external resources to expand new business is worth more research. This is especially crucial for platform firms at their early stage that offer solutions to their innovative and customised solutions before they are capable of establishing a platform ecosystem. Nevertheless, the existing literature is focused more on platform governance and openness to promote complementors' contributions while addressing the flexibility and stability paradox, and thus does not pay adequate attention to value creation dynamics.

2.3 Platform-Enabled Service Innovation

The digital logic of information and communication technologies (ICTs) enables a full spectrum of service innovation possibilities in digital organisations that rely on digital platforms (e.g., Apple's iOS) (Tilson *et al*., 2010; Lyytinen *et al*., 2016). Service innovation refers to the process of the development of a novel or enhanced service concept that allow customers to accomplish their tasks (Bettencourt, 2010). The concept of service innovation evolves, which can be conceptualised as the "rebundling of diverse resources that create novel resources that are beneficial to some actors in a given context" (Lusch and Nambisan, 2015, p. 161). Platforms are critical to helping resource density and better ways for value co-creation. In these digital organisations, platform-based service innovation needs to be developed to better serve the platform participants and encourage their value co-creation activities (Fu *et al*., 2017), which may pose challenges to firms. Although successful attempts are made, firms still find it hard to build appropriate business models on platform services.

In manufacturing industries within which manufacturers become solution providers through new service development, the service-oriented value creation is boosted by digital technologies. For example, IoT platforms contain digital functionalities that allow organisations to gather valuable data about product usage and conditions in users' contexts and create new digital (visualising and/or monitoring) services (Zhu and Furr, 2016; Gebauer *et al*., 2020a). Over time, additional digital functionalities such as in the form of advanced sensors, data analytics and storage can be integrated with the platform's core, thereby enriching a firm's value proposition (Markfort *et al*., 2022). As such, a digital platform approach receives increasing attention to enable innovative service offerings

(Eloranta *et al*., 2021). The ultimate goal is to transform the business model by creating and capturing value on digital platforms (Chesbrough, 2011). Further, information system researchers have pointed out that firms can leverage the data collected and accumulated on the platforms to create new products and services using malleable and dynamic digital technologies (Yoo *et al*., 2012).

While agreeing with Fu *et al*. (2022) on the value of digital platforms and the potential for various levels of innovation in service offerings, it should be noted that the subsequent performance of platform-enabled servitisation is not guaranteed. Many research efforts are thus made as regards the role of platforms in stretching the boundaries of digital servitisation (Tian *et al*., 2021a), in creating the synergies between absorption mechanisms and complexity reduction in the servitisation context (Eloranta *et al*., 2021), and in addressing complexities via different types of platforms at each stage of servitisation (Fu *et al*., 2022). Beyond the aforementioned complexities, the platform approach is widely applied in this aspect due to its modular architecture that can address the paradox such as leveraging external resources while maintaining control, enriching value propositions while controlling costs. For example, Wei *et al*. (2019) showed that firms can achieve different control benefits through product modules, service modules and knowledge modules, which have differential effects on platform openness and controlling solution networks. Cenamor *et al*. (2017) proposed the use of a platform modular architecture, particular information modules with which manufacturers pursue both customisation and standardisation, and operational efficiency when they implement advanced services. Because more business partners are involved in service provision, Eloranta and Turunen (2016) shed light on the mechanisms by which manufacturers can realise servitisation on

platforms. These mechanisms include connecting actors to enable further collaboration and the development of new markets; resource sharing to benefit all involved stakeholders in service innovation; and system integration for efficient service delivery. This explains how servitisation could unfold from the platform perspective, and it would be equally valuable to explore the key role of organisational users, including the transformation of new organisational identity in platform use, to achieve this strategic goal.

Importantly, extracting value from platform implementations is often associated with the need for the organisation-wide digital transformation, which requires firms to make organisational changes due to the wide diffusion of digital technologies and their remarkable progress (Hanelt *et al*., 2020). Despite the considerable attention paid to digital transformation and servitisation, their interaction is overlooked. Paschou *et al*. (2020) thus called for more research on the interaction between digital transformation and servitisation, both of which have deep implications for business performance.

Besides, though digital platforms have been widely applied to B2C areas, they are mainly limited to social media platforms and e-commerce platforms; how B2C firms deploy digital platforms remains largely neglected. This observation echoes Paschou *et al*. (2020)'s pointing out of a research gap in that extant literature primarily lies in the machinery and equipment industry. IoT platforms and other technological platforms are mainly implemented for servitisation in the context of B2B business to expand revenue streams. This observation is also captured by Dotzel and Shankar (2019), who found that when firms offer both B2B and B2C service innovation, the former has a greater impact on firm value than the latter.

Although a platform approach has received growing attention when manufacturers follow a servitisation strategy, there is a dearth of empirical research on ways platforms can be adopted by manufacturers to generate superior service performance of the servitisation journey. In other words, little is known regarding how and why some servitised manufacturers are successful when they provide customer-centric solutions via a platform approach. Besides, future researchers could further investigate the new organisational capabilities (e.g., value co-creation capabilities, network orchestration) necessary for product firms to manage and pursue platform-based servitisation, and the value creation dynamics thereof from a process perspective (Tian *et al*., 2021b). To recap, platform firms can create service innovation to attract value creation participants for co-creation (Lusch and Nambisan, 2015; Fu *et al*., 2017). Building a successful business model based on the service innovation poses a challenge to platform firms. As mentioned, the role of organisational users of platforms in starting and pushing forward digital servitisation is equally important, thus meriting more research attention on consumer product manufacturing industries given the aforementioned research gaps. Therefore, it would be significant to examine how digital platforms and their organisational users interact with each other to generate enhanced value through new service provision.

2.4 Evolution of Digital Platforms

Researchers have recognised organisational platforms as evolving entities (Jovanovic *et al*. 2021; de Reuver *et al*. 2018; Zhao *et al*. 2020), which could affect the subsequent value generation opportunities and enable appropriate business models. Researchers have recently been turning their attention towards the dynamics of platform development through the dominant qualitative designs. Eaton *et al*. (2015) explored the

evolution of boundary resources to explain the platform development characterised by the paradox of the simultaneous control and generativity. Dattée *et al*. (2018) explained how the platform companies could make potential ecosystem members commit their resources towards a de novo ecosystem creation but only focus on the formation of new value propositions. Zhao *et al*. (2020) studied the platform evolution and strategies in competition with the rivals but derived the insights from multi-sided transaction platforms. By considering both innovation platforms and transaction platforms, Teece (2017) conceptually identified a set of dynamic capabilities across the phases of the platform life cycle, from birth, expansion and leadership to self-renewal. From a business model perspective, Markfort *et al*. (2022) explored the emergence of IoT platforms and found that a shift in a firm's business model can be accomplished through platform skimming, platform revenue generation and platform orchestration. In contrast, West and Wood (2013) looked at the failing case of the once most popular Symbian platform from 2000-2010. They explained how the platform ecosystem evolved and lost its market share to new competitors due to the limitation in its conception and leadership of the ecosystem. Notable exceptions include the work of Shi *et al*. (2021), who examined how an innovation platform in a nascent sector emerges and develops. However, the related studies do not bring implications to how digital-born service providers and manufacturing incumbents develop their platforms, leaving a gap this study intends to address.

There exists an extensive body of knowledge on platform development through architecture design and governance (Tiwana, 2015; Thomas *et al*., 2014), and on value creation and/or value capture considering decision making and the behaviours of platform owners and complementors from the business ecosystem perspective (Tsujimoto *et al*.,

2018). This observation is also reflective of the fact that a large bulk of research is focused on an established and successful platform ecosystem, and hence highlights the significance of shedding light on the early stages of platform development. In a similar vein, Cao *et al*. (2023) maintained that the recent research stream on platforms pays predominant attention to governance, relationships, and coordination while insights on development-related questions are largely absent (Facin *et al*., 2016; Tiwana *et al*., 2010).

It would be thus appropriate to argue that existing insights and findings from prior work may not be applicable to platforms in these two contexts for three primary reasons. First of all, a functional platform consists of the platform owner and complementors, who coordinate with each other via platform governance (Jacobides *et al*. 2018; Tiwana *et al*. 2010). Although it is possible to uncover the de facto structure of successful platforms with their established modules, it would not be easy to develop an *ex ante* understanding of how these modules and the platform ecosystem came into being. Second, it is critical to acknowledge the co-evolving nature of platforms, organisations and industries (de Reuver *et al*. 2018). Even though a well-established platform is likely to be stable, it is critical to understand how a platform grows and experiences constant change, especially in the early stages, to make it stand out in the markets. Third, most innovation platforms emphasise the role of complementors; however, in the context of open innovation, corporate customers play an equally important role, which shapes the development of new products and services before they reach maturity.

Furthermore, to reap the full benefits of the platforms, platform firms can combine with various levels of architectural openness and different logics of platform leverage, production, innovation and transactional architectural leverage to evolve platforms into

platform ecosystems (Thomas *et al*., 2014). This type of platform evolution could be especially salient in manufacturing incumbents, which often start with internal or many-to-one production–leverage platforms and go on to aim for digital servitisation, which often requires the development of business ecosystems as the number of supply chain entities and business collaborators grows. Though many platform firms could manifest multi-logic leverages concurrently, how such multi-logic leverages develop and interact with each other is seldom portrayed in the context of digital servitisation. For example, some traditional manufacturers have been observed to engage in strategic acquisition of other technology firms as a way of platform investment where organisational memory and resources are embedded. Consequently, innovative products and services can be developed along with the platform development.

Clearly, relatively little research attention is devoted to the early stages of digital platforms in service industries and manufacturing services. Enriching the knowledge on value creation dynamics along with platform development has become significant because platform firms across industries should have a holistic view of the emergence and development of platforms. Moreover, the platform development could be interpreted from different perspectives, such as architecture design and governance, and architectural leverage. The evolutionary phenomenon could also be explained through the interactive relationship between technologies and organisational actors, that is, behaviours that platform firms adopt to create value and evolve their platforms concurrently. Our understanding in this aspect can serve as the guideline for how platforms emerge and expand along with the development of market offerings.

2.5 Synthesis of Related Literature

In summary, digital platforms due to its generativity and convergence, provide technical capabilities for value co-creation. platform leverage logics in combination with architectural openness create a platform ecosystem, where innovative contributions can be provided by third parties. To create enhanced value from the platform and platform ecosystem, open innovation practices such as formal governance with intellectual property (IP) rights or developing boundary resources to facilitate external participation should be properly implemented along with the internal organisational resources. Besides, to fully leverage from the adoption of digital platforms, service innovation plays a part in attracting more value creation participants, whether they are customers or business partners to co-create value (Fu *et al*., 2017). This could in turn affect platform development and technological capabilities, creating improved service innovation possibilities.

Affordance theory, which will be discussed in detail below, is used to interpret the aforementioned research phenomenon in service and manufacturing industries, focusing on how platform firms generate realised strategic value from digital platforms to benefit them and involved parties. Arguably, affordances are value creation opportunities (Simmonds and Bhattacherjee, 2017). As such, the primary step of this thesis is to identify value creation opportunities that focal firms can capture to achieve the strategic business value from their IT investment. The second step of the thesis is to investigate how firms perform specific behaviours to benefit from the recognised opportunities. The two steps help to address the research question: How do digital platforms enable value creation in service and manufacturing industries?

Given that service innovation becomes a large share of market offerings in service providers and servitised manufacturers, looking at these two industries could give us a holistic view of different behaviours taken by platform firms with specific development needs could affect value creation in the context of digital platforms. Besides, based on the literature, significant knowledge gaps in platform-related contexts in business sectors within the service and manufacturing industries. First of all, despite the central role that service play in current economies, as focal in the value proposition and creation, there is a scarcity of research on open service innovation (Randhawa *et al*., 2016; Rondi *et al*., 2021). Knowledge-intensive service industries, compared to other types of service industries (e.g., hospitality and tourism, transportation and logistics), would involve the participation of customers due to the complex nature of B2B offerings (Zhang and Xiao, 2020; Clarke *et al*., 2023). Therefore, high-technology ventures that provide knowledge-intensive services would our research target for study 1.

Second, as noted previously, manufacturing industries, especially consumer product manufacturers are not thoroughly studied in digital servitisation literature (Paschou *et al*., 2020). Moreover, a majority of servitisation literature focus on B2B manufacturers that can be the early adopters of IoT platforms and other technological platforms to expand revenue streams. Besides, transition into service providers can create additional value adding capabilities for traditional manufacturers (Santamaría *et al*., 2012). How such service innovation could bring along such organisational capabilities through the use of self-developed platforms deserve further research attention, which can complement existing servitisation literature exploring organisational capabilities in the context of digital

servitisation (Ardolino *et al*., 2017; Lenka *et al*., 2016; Momeni *et al*., 2023; Chirumalla *et al*., 2023).

2.6 Theories Applied to Platform-Enabled Value Creation

Theories can be drawn on to interpret the phenomenon of interest or research topic, and they could serve as paradigms to guide a research design. As illustrated in Table 2.1, few theories are applied to explain value creation in the context of digital platforms, which is reflective of the infancy of platform-related research phenomenon. Moreover, the used theories do not place a specific focus on the utility or value of technologies. For instance, Lusch and Nambisan (2015) proposed that service-dominant logic underlies the importance of knowledge and skills behind service exchange and innovation. Benitez *et al*. (2020) used a social exchange perspective to explicate value cocreation among the actors in Industry 4.0-oriented ecosystems. Drawing on organisational capabilities lens, Schreieck *et al*. (2021) uncovered relationship-driven capabilities and technology-related capabilities that platform firms need to demonstrate to strike a balance between value co-creation and capture in the platform ecosystem.

The preceding discussion may suggest that organisational capabilities are crucial to create value with the use and implementation of platforms. According to the literature review, although several researchers applied grounded theory to interpret the phenomenon of interest, they mentioned the importance of organisational capabilities or their development to garner innovation and value (Schreieck *et al*., 2021). For example, Tian *et al*. (2021b) emphasised that developing orchestration capabilities is crucial for platform firms to ensure all actors co-evolve and their input and co-creation activities are combined to drive platform development and different leverage logics. Given this, it is paramount for

firms to identify and cultivate new organisational capabilities to realise greater and ongoing value creation in different research contexts.

Meanwhile, with the prevalence of digital technologies, information systems scholars have directed their attention to the link between IT and organisational capabilities. To generate business value from investing in digital technologies, digital-born new ventures are required to form IT-based dynamic capabilities through actualising digital affordances as they interact with digital technologies (Sadreddin and Chan, 2022). Battleson *et al*. (2016) examined how IT capabilities of cloud computing could be used to enhance dynamic capabilities by identifying two sets of factors relating to both organisations and cloud computing features. However, incumbent firms that leverage digital technologies to create business value are highly likely to encounter different forces of inertia in developing IT-enabled dynamic capabilities (Mikalef *et al*., 2021). Further, as digital platforms are increasingly implemented to launch digital offerings (e.g., Gebauer *et al*., 2020b; Markfort *et al*., 2022), in addition to developing IT capabilities to enable business models and operations at scale (Sjödin *et al*., 2021), tapping into opportunities based on those IT capabilities may bring greater implications to performing value creation activities.

To consider the interaction between technology agency and human agency in the digital age, drawing on the affordance theory is appropriate to address the overarching questions. The subsection 2.3.6 below will detail the affordance perspective. In line with extant studies on IT affordances (Strong *et al*., 2014; Chatterjee *et al*., 2020; Leidner *et al*., 2018), because IT affordance, use and outcome are distinguished from each other, IT affordances would lead to various types of uses (actualisations) and outcomes. As such,

using the affordance perspective to connect IT assets and their effects on organisational capabilities may need a more nuanced perspective on the IT assets and their affordances, actualisations and subsequent outcomes (Steininger *et al*., 2021). This research direction can complement the existing organisational capabilities literature because currently there is an assumption that when organisations have invested in IT resources and utilised them, these IT resources can be deployed strategically and produce an ideal effect towards business outcomes. This over-simplified assumption in the existing literature amplifies the necessity for a dynamic perspective on resource leverage and orchestration to realise more value (Mikalef *et al*., 2021). Given this, it is important to recognise that those organisational capabilities would be cultivated and strengthened by firms in different ways to varying degrees (Barreto, 2009), which is more reflective of real-world situations.

A key conclusion from the discussion is that researchers at the intersection between digital platforms and value creation tend to underuse well-established theoretical perspectives, but highlight the importance of organisational capabilities because some have suggested some specific capabilities to enable firms to get more out of the value generation in the platform ecosystems. Further, given the potential link between IT affordances and the development of new organisational capabilities (Steininger *et al*., 2021), it would be significant to explore platform affordances in different research contexts and the formation of corresponding organisational capabilities.

Table 2.1: Literature Review on Platforms Related Value Creation

Authors	Theoretical perspective	Journal	Main insights
Lusch and Nambisan (2015)	Service-dominant logic	MIS Quarterly	This study provides a broadened conceptualisation of service innovation based on S-D logic and proposes the tripartite service innovation framework.

Schreieck *et al*. (2021)	Organisational capabilities	Journal of Information Technology	Technology-related capabilities and relationship-driven capabilities are identified to co-create and capture value in platform ecosystems as companies adopt a platform ecosystem strategy.
Kim and Altmann (2022)	n.a.	IEEE Transaction on Engineering Management	This study explores the activities of platform providers to promote innovation using data from AppExchange of Salesforce and suggests that platform providers should position their software services strategically to shepherd software ecosystems.
Mariani and Nambisan (2021)	n.a.	Technological Forecasting & Social Change	This study introduces research-driven online review platforms (RORP) and illustrates how they operate and deliver value through innovation analytics. This study stresses the importance of open innovation from the clients' perspective to benefit from using RORP and 'relative closed' digital innovation experiments to protect the innovation knowledge.
Sturgeon (2019)	n.a.	Global Strategy Journal	This conceptual paper argues for three strategic elements underpinning the business model in the digital age – modularity, open innovation and platforms – and explores strategic options for firms to leverage in developing areas.
O'Mahony and Karp (2020)	n.a.	Strategic Management Journal	This study investigates how platform participation strategies evolve under varied governance modes with changing access and control conditions.
Jovanovic *et al*. (2021)	n.a.	Technovation	This study examines the co-evolution of platform governance, platform architecture and platform services in the B2B industrial context. In the study, three platform archetypes are identified, and each display an innovation mechanism, contributing to the discovery of platform service.
Tian *et al*. (2021b)	n.a.	Industrial Marketing Management	This study provides insight into the platform firms' efforts to ensure all actors co-evolve during platform development and simultaneously facilitate value co-creation.
Benitez *et al*. (2020)	Social exchange theory	International Journal of Production Economics	This study investigates how the innovation ecosystem helps small and medium enterprises (SMEs) co-create Industry 4.0 solutions through resource integration, and how such ecosystems consolidate and evolve and reach the final stage of a platform-driven ecosystem structure.

2.7 Affordance Theory

Considerable research efforts have been made to extend and refine the theory of affordances. Affordances are dynamic, emerging from the interaction between the object with certain features, and goal-oriented users with action capabilities. In the digital age, affordances are exploited to create innovation (Yoo *et al*., 2012). Gupta and Bose (2019) identified digital infrastructure affordances, such as flexibility, modularity and generativity, which are referred to as the properties of innovative technologies to develop new business designs. Liu *et al*. (2022) suggested that the generativity and convergence of digital affordances create the sets of affordances, enabling organisational innovation with agility and flexibility. To explore entrepreneurs' participation and contribution to the platform, Nambisan *et al*. (2019) suggested three common themes associated with digital innovation – namely, openness, affordances, and generativity – and propose their potential interdependencies.

Despite their foundational knowledge of digital platforms, these studies do not delve into the specific affordances in platform-related contexts. Additionally, given that firms are now developing increasing numbers of business activities based on the affordances (Bharadwaj *et al*., 2013), it is significant to explore the application of digital platforms from an affordance perspective, shedding light on how businesses can be initiated, enabled and supported with the affordances. Because affordances are widely applied in disciplines and we lack a commonly accepted definition of an affordance, Evans *et al*. (2016) provided a threshold of criteria for ensuring the conceptual validity of proposed affordances, highlighting that an affordance is not a feature of the object nor an outcome and has variability. Because affordances are influenced by technology and users,

according to Thapa and Sein (2018), they can be categorised into functional affordances and relational affordances. Compared to relational affordances that are more tightly intertwined with the goals or capabilities of users, functional affordances are tied closely to the material properties of technologies. For example, a chair offers the functional affordance of sitting; simultaneously chairs can also be used to play games, which represents the relational affordance of entertaining. These embedded functional affordances only provide the springboard from which the second type – more implicit relational affordances – would emerge (Zhou *et al*., 2021). Though scholars have recognised that first-order affordances lead to second-order affordances, whether the actualisation of functional affordances could result in the perception of higher-level affordances or whether any dependencies exist among them (Strong *et al*., 2014) is underexplored, which merits further inquiry (Osmundsen *et al*., 2022).

Despite the debate over the ontology of affordances, this research concurs with the majority of researchers suggesting a relational view of affordances. Given that affordances are decided neither by the object nor by the user alone, scholars examine how different types of affordances would emerge and be actualised by users through exploring a bundle of affordances (Volkoff and Strong, 2017; Naik *et al*., 2020; Thapa and Sein, 2018) and affordance networks. Affordance networks refer to the interactions between those affordances and corresponding outcomes that together serve broader organisational goals (Burton-Jones and Volkoff, 2017). Thapa and Sein (2018) found that functional affordances can lead to the emergence of socially constructed affordances. Chatterjee *et al*. (2020) and Wagman *et al*. (2016) investigated how affordances co-align to produce a superordinate affordance. In another stream of literature, researchers consider the

philosophical treatment and suggest that things – that is, technological artefacts – are identified by the use, which reveals itself by means of affordances (Turner *et al*., 2005). Drawing on the Heideggerian perspective, Lanamäki *et al*. (2014) and Osmunderson *et al*. (2022) pointed out the notions of 'familiarity', 'equipment' and 'referential totality' in enriching the relational aspect of affordance. According to them, developing a familiarity with equipment's referential totality explains how affordances emerge, from being latent to being visible to users. The Heideggerian perspective is useful to interpret affordance actualisation because of the treatment of familiarity and equipment 'in-the-world'. In this world, individuals treat entities as *ready-to-hand*, coined by Heidegger as an *in-order-to* (Riemer and Johnston, 2014). In other words, users demonstrate their familiarity by understanding the referential whole, namely, recognising how one piece of equipment relates to another, actions taken towards the equipment, their purpose in doing it and the identity they assume in doing so. Using a chair as an example, as a student, we go to a library, take a seat and start to study in the library, whereas as a customer in the context of a furniture store, we probably spend more time looking around, trying out some chairs, feeling their texture and so on. Though chairs offer the sitting affordance in both contexts, different actions are performed. Osmundsen *et al*. (2022) thus encouraged future researchers to investigate affordance actualisation from the Heideggerian perspective.

Further, how to increase the level of affordances has implications for the affordance literature in that affordances with a high level are more likely to be actualised and thus help to achieve organisational outcomes. This also explains how designers could manipulate the material features of specific artefacts to influence users' perceptions of artefacts and introduce some features first and then more advanced features at a later stage. At the

organisational level, when digital artefacts and other technological resources are updated and accumulated over time, the level of some affordances could increase accordingly. However, there is a dearth of research on how affordances evolve over time and manifest themselves to help organisations with goal achievement.

Despite the benefits that can be expected from affordance, these benefits may not be realised if actualisation cannot fully be implemented or is not implemented at all. Therefore, the number of studies on affordance actualisation to evaluate how affordances would be actualised in diverse research contexts is growing. First, a handful of studies exist on affordance actualisation, identifying the constructs, conditions and contingent factors to enable or constrain affordance actualisation (e.g., Thapa and Sein, 2018; Anderson and Robey, 2017; Tim *et al*. 2017, 2020). However, they tend to lack theoretical support on the causal relationship between these contingent factors with the entire process of affordance actualisation. Failing to probe the underlying mechanism of affordance perception and actualisation may generate useful yet fragmented concepts such as affordance potency (Anderson and Robey, 2017) and factors such as courage to actualise a harmonious fit of affordance (Chatterjee *et al*., 2020) to benefit from affordances.

Second, there exists confusion between affordances and actions taken by users to enact these affordances. One group of researchers tends to ignore the process of affordance actualisation, implying users can benefit from affordances with ease (Pozzi *et al*., 2014). Once the affordances are perceived, they can be spontaneously actualised and generate subsequent outcomes. Despite the work of Leidner *et al*. (2018) in providing conceptual distinctions among the concepts of feature use, affordance and outcome, less is known regarding the actions users perform to enact affordances. Clearly, different users may take

dissimilar actions to actualise the same type of affordance, as mentioned in the example of chairs in different contexts. The empirical evidence provided by Leidner *et al*. (2018) has vividly substantiated this point, showing that though enterprise social media affords new hires to participate in its sponsored events, facing the same affordances, different types of new hires take different actions even in the same context.

Meanwhile, as noted, affordances encourage behaviours and other outcomes (Withagen *et al*., 2012). In this regard, there exist differences between actualised outcomes and the outcomes of the direct use of the object. Citing the example of commuting to work in the study by Leidner *et al*. (2018), we can see the goal of riding the train (i.e., using the technology) is getting to work. The passengers could perceive and realise other affordances along the way such as working and napping. The actualised outcomes are that passengers can complete some work before arriving at work or arrive at their destinations in a relaxed state of mind. After they benefit from the affordances, the goal of a user using a moving object for commuting could be arriving at work, plus the related additional benefits or outcomes. As a result, their goal becomes more specific, that is, getting to work with some of their work completed and/or in a relaxed state of mind, which can in turn help to accelerate affordance actualisation in more effective ways, such as bringing complementary objects (e.g., U-shaped pillow to assist in napping).

Though it may be fairly easy to distinguish the differences between outcomes and affordances, one may confuse the affordance with the subsequent actions taken to benefit from affordances. For example, one may sit to actualise the sitting affordance offered by a chair. However, to achieve an organisation-wide goal, a series of actions or behaviours involving groups of individuals would be needed to actualise one type of affordance. To

solve the confusion and better understand the relationship between the affordance and actions, both Wagman *et al*. (2016) and Chatterjee *et al*. (2020) highlighted the need to consider multiple subordinate affordances that could be nested inside a superordinate affordance. They both cited an example provided by Ye *et al*. (2009), who described the notion of affordance nesting, citing the following concrete examples of more specific behaviours: '[T]he affordance of drinkable from has a nested structure of (component) affordances that include the affordances for pour-in-able, graspable, and liftable. If any of these nested affordances are not present, then the object does not afford drinking from [emphasis added]' (p. 2).

They regarded pour-in-able, graspable and liftable as subordinate affordances, which complement each other to actualise the superordinate drinkable affordance. Apparently, individuals can take actions such as pour, grasp and lift to actualise the superordinate drinkable affordance. Breaking down the superordinate affordance can be useful to consider the complexities associated with high-level affordances, which can be actualised in multiple ways. For example, instead of pouring, grasping and lifting to enact the drinkable affordance, users can also use a straw to benefit from drinkable affordances as they develop knowledge of enacting the drinkable affordance. Further, the level of affordances and capabilities of users can also influence the actions needed for affordance actualisation. An adult can lift the bottle with one hand, but if the adult has injured their hand, then they would need to lift the bottle with both hands before their recovery. Because an affordance perspective is now applied to IS areas in real-world business, the affordances perceived could be superordinate affordances that are actualised in more than one way. Therefore, providing more fine-grained information is necessary to probe into the actions

organisations perform to understand the ways superordinate affordances can be actualised, from which it is possible to develop 'best practices' for these users at the time of affordance actualisation.

Further, in the affordance – actualisation theory, researchers expect actualised outcomes to be naturally followed after certain actions are taken, largely ignoring the effectiveness of the actualised outcomes. As mentioned previously, affordances can be completely, incompletely or unactualised despite the devoted behaviours. Besides, because actualisation depends on the level of affordances and capabilities of users, enhanced capabilities or high-level capabilities could have a direct impact on the affordance actualisation. In line with the previous section that suggested understanding changes (i.e., platform development) using an evolutionary process view, organisations would learn, modify and garner new variations in their procedures, structures, technology or culture at different times (Santangelo and Meyer, 2017; Hanelt *et al*., 2020). During this process, more alternative actions would follow to actualise the affordances as specific business goals change at different times to support the broader organisational goal. More importantly, organisations have opportunities to cultivate organisational capabilities, improving the effectiveness of outcomes. Currently, less is known as regards the relationships between the potentially connected concepts of affordances and capabilities, and how they are combined to help organisations achieve their goals.

Last but not least, when the affordance perspective is applied in IS research, most attention is paid to communication technologies, such as social media platforms (e.g., Karahanna *et al*., 2018; Kathrin *et al*., 2021; Sæbø *et al*., 2020), including enterprise social media (Leidner *et al*., 2018), firm-sponsored online communities (Priharsari *et al*., 2020)

and other types of online communities (Chen *et al*., 2019; Nan and Lu., 2014). Meanwhile, though a few studies exist on how digital technologies such as big data and IoT create value for firms through the affordance lens (e.g., Lehrer *et al*., 2018; De Luca *et al*., 2021; Naik *et al*., 2020), they have not been explicit in the role of the digital platforms built on these advanced technologies. This gap is significant to address because firms now increasingly build and use digital platforms to realise their organisational goals such as digital transformation (e.g., Nambisan *et al*. 2019; Wimelius *et al*. 2020), digital servitisation (e.g., Fu *et al*., 2022; Tian *et al*. 2021a; Cenamor *et al*. 2017) and value co-creation (e.g., Priharsari *et al*. 2020; Schreieck *et al*. 2020). Hence, this study enriches affordance literature through exploring the role of different types of digital platforms in enabling value creation dynamics as manifested by the market offerings.

Overall, affordance theory is appropriate to interpret the research phenomenon for two reasons. First, as mentioned early, affordance are possibilities for value creation (Simmonds and Bhattacherjee, 2018), and given that benefits reaped from IT investment vary considerably in organisations, affordance actualisation coincides with the realised strategic value from digital platforms. Second, because current literature looks at transaction-oriented platforms, digital platforms that prioritise innovation leverage are seldom explored in affordance literature. Due to different types of platforms, and different goals of platform users, exploring different platform affordances would be a fundamental step in exploring the outcomes that those affordances could bring along.

Third, when affordance theory is compared with other theories reviewed in section 2.6, affordance theory is particularly appropriate to provide direct insight into how IT users apply technologies based on the utility of technologies and users' capabilities and goals. In

other words, the other theories, such as social exchange theory, service-dominant logic, or organisational capabilities lens, are more focused on resources such as technology and relationships to support the value creation process (Chou et al., 2014; Schreieck *et al*., 2021). Though useful in interpreting the value of organisational resources and relationship resources, these theories do not shed sufficient light on how platform firms can access, develop, orchestrate, or accumulate these resources over time from a process perspective.

2.8 A Conceptual Framework and Research Agenda

Figure 2.1 illustrates the relationship of the independent but connected concepts. This model has the advantage of connecting related literature that remains sparse and isolated to derive a coherent framework using the affordance perspective. Based on the preceding discussion, platforms render greater value creation as they evolve (Tian *et al*., 2021b). Digital platforms and the constituent technology components remain at the core of the framework because they play a dual purpose in innovating market offerings by acting as both an operant and an operand resource. Specifically, digital platforms with the embedding digital artefacts can become the foci of innovation upon which customers and business partners can contribute and promote generativity. Knowledge resources and capabilities from external sources condition platform development. Like any other digital artefacts, platforms become an active agent in the ecosystem and could further generate product and service innovation, affecting other actors and their behaviours and enhancing value creation in the open innovation paradigm. Concurrently, like traditional IT, digital platforms serve as facilitators, ensuring that value co-creation that underpins service innovation is effective and efficient, as manifested by its facilitating role in the following figure. This framework thus also responds to the call for more research on the dual roles of

IT (Lusch and Nambisan, 2015). Through the interaction between platform and organisational users, the perceived affordances can help firms with value creation by fulfilling the corresponding behaviours. Such value creation in the form of innovative product and service offerings could in turn lead to more opportunities to serve a growing number of customers and to collaborate with a wider range of business partners. The consequence is that focal firms can access and leverage resources and capabilities of these stakeholders to empower the platform, which could result in either platform owners' perception of new affordances or the readiness of focal firms to actualise existing affordances in new ways.

Figure 2.1: Integrative framework of value creation on innovation platforms

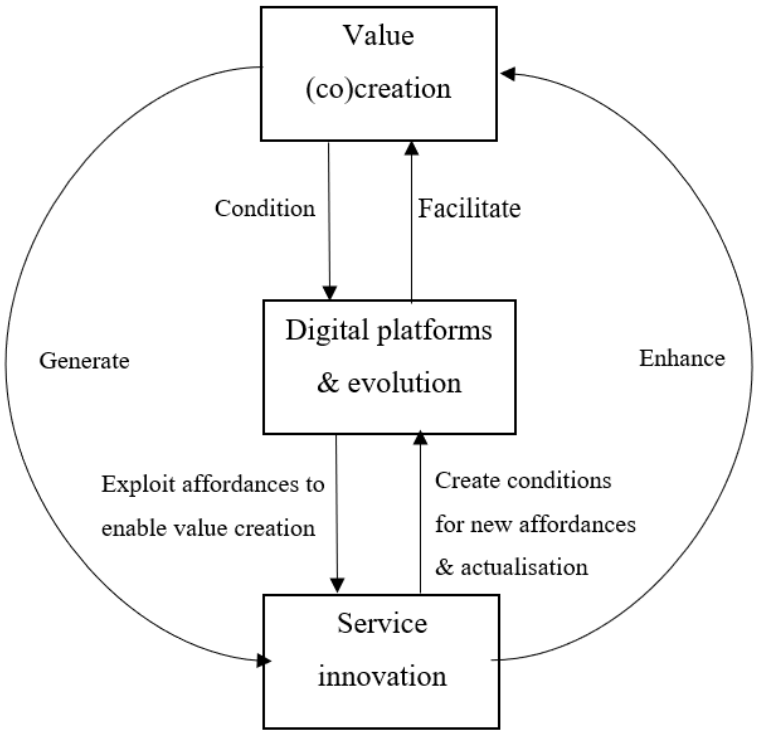


Table 2.2: Main Research Gaps and Related Future Research Enquiries

No.	Research gap	Future research direction
1	Most studies looking at how firms implement innovation in third-party platforms with the involvement of customers and/or business partners, such as social media platforms, and crowdsourcing platform, and other Internet-based platforms.	1a. Explore the application of advanced digital technologies, such as AI, big data and the impact of digital platforms that prioritise innovation leverage on open service innovation 1b. Explore self-built platforms from young or traditional firms that depends on digital platform for value creation
2	Only a few platform studies look at platform evolution, including sharing platforms and innovation platforms using world-renowed platform examples.	2. Investigate the platform development in service providers and manufacturing incumbents, looking at their driving forces and consequences in different research contexts
3	A majority of digital servitisation studies do not pay adequate attention on digital platforms in B2C contexts, and mainly focus on industrial product manufacturers.	3. Explore consumer product firms and look at the impact of digital transformation on servitisation as the performance outcome of digital servitisation go beyond the mere technology use
4	Digital servitisation literature highlights the importance of developing capabilities to enable manufacturers to pursue servitsed business model successfully, yet without specifying the role of technologies, particularly digital platforms.	4. Explore the mechanism through which affordances could facilitate the development of new organisational capabilities as firms transform or innovate their business models
5	Studies at the intersection between digital platform and service innovation in service and manufacturing firms tend to underuse well-established theories and do not take into account both technology agency and human agency in platform use.	5. Investigate the use of affordance theories to build a mid-range theory or other sociomaterial theories, and how this perspective could create novel insights into product and service innovation in both service and manufacturing industries

Based on the insights from this chapter, the researcher identified several research gaps, with which this thesis intends to address (see Table 2.2). Specifically, the first and second gap motivates Study 1, while the first, third and fourth gaps are the motivation of Study 2. The final fifth gap leads to the selection of affordance theory as the overarching perspective for this thesis. Study 1 deals with innovation platforms upon which service providers achieve economies of innovation and complementarity to serve diverse customers, and thus aim to address the following RQs: 1) What are the affordances of innovation platforms in knowledge-intensive service providers?, 2) How do innovation platform affordances empower service providers to create value for clients? Study 2

explores platform-enabled servitisation, which may need a multi-logic architectural leverage as mentioned in section 2.4, and answers similar questions: 1) What are the affordances of digital platforms in servitised manufacturers?, 2) How do platform affordances empower manufacturing firms to pursue servitisation?

Starting with the affordance perspective, a majority of empirical studies apply the perspective in new research contexts to interpret the phenomenon of interest and develop a mid-range theory in their research context (e.g., Tim *et al*., 2017; Herterich *et al*., 2022). Despite their contributions to knowledge of the affordance concept, several gaps remain as noted in the preceding table. Among them, the researcher intends to fill the gaps of affordance evolution and their dependencies, as well as their linkage to organisational capabilities, both of which are under-explored and have been called for (Strong *et al*., 2014; Steininger *et al*., 2021). Second, though platform evolution has received a handful of studies, limited empirical investigation is focused on digital platforms and early stages of platform evolution. Moreover, less is known as regards how digital platforms evolve along with value creation trajectories. This gap is surprising because value creation via platforms plays a key role in the success of platforms, and given both of them would develop over time, how they interact to yield a synergistic benefit is particularly relevant to both researchers and practitioners. Third, researchers looking at platform development have applied a theory-building approach without drawing on any well-established theories, except Shi *et al*. (2021) who explored the emergence and development of innovation platform through the dynamic capabilities view. This reflects the nascent state of studies on innovation platforms, and it is essential to build a mid-range theory for platforms as a basis for further research in the IS discipline. Fourth, although the dynamic capability view

has been proposed to combine with the platform approach to understand how a firm evolves its platforms in the long term (Facin *et al*., 2016), how such capabilities are cultivated through digital platforms is underexplored. Organisations can pursue platform-enabled servitisation to generate value, however, our understanding of how such strategic moves can lead to superior firm performance and competitive advantage is lacking. As such, it would be significant to apply a novel approach to exploring the emergence and development of much needed capabilities, which could be realised by firms performing a broader set of related activities.

Study 1 examines innovation platforms in service industries and starts with an early stage of platform development as per Shi *et al*. (2021), focusing on value creation dynamics underlying market offerings. For platform-native service providers, the effectiveness of open innovations conditions the development of innovation platforms, which influences subsequent product and service development. Given that launching market offerings is one of the initial steps to attract potential customers in their industry, and they may face dynamic changes before the platform gains maturity, how product and service development unfolds may affect the competitiveness firms strive for. Therefore, investigating the development of market offerings was deemed an appropriate starting point of Study 1.

Meanwhile, Study 2 is focused on platform-enabled servitisation in consumer product manufacturers across industries. Compared with B2B manufacturers, consumer product firms lag behind in expanding revenue streams through servitisation (Paschou *et al*., 2020). Triggered by the internal and external factors, such as the recent COVID-19 pandemic, these firms have started to pursue digital transformation to varying extents. Untangling the relationship between digital transformation and subsequent digital

servitisation could thus provide valuable insights and guidelines, which are absent in the current literature (Paschou *et al*., 2020). Meanwhile, most studies look at a limited number of digital technologies (mainly IIoT) adopted by firms for servitisation, and most often in isolation; therefore scholarly efforts should be made to examine the combinative interaction of given stacks of digital technologies (Paschou *et al*., 2020). Given this, special attention would be given to how firms perceive and actualise the affordances as they interact with different types of platforms because they can proffer the same or complementary affordances to goal-oriented users. For manufacturers, especially medium to large enterprises, it is the case that they would have multiple technological platforms whether they are self-developed or more standardised ones provided by technology suppliers, to tap into different logics of platform leverage for value creation. As such, it would make sense for firms to maximise value creation from the platform ensemble with underlying digital technologies by means of enacting affordances in practice and developing corresponding capabilities. This is the focus of Study 2.

2.8 Concluding Remarks

Digital platforms and open innovation unleash great potential for product and service innovation, even transforming the business models of established firms. Different from a major stream of the literature that considers crowdsourcing and crowdfunding platforms as well as social media platforms, this thesis follows another line of enquiry focused on how digital platforms can be developed with the support of open innovation, which is often analysed in the context of ICT service, digital servitisation and e-government in extant literature. Following this, this thesis extends the literature by examining the interplay between digital platforms and open innovation. Based on the review, despite the

popularity of these phenomena among academics and practitioners, research on the interplay between digital platforms and open innovation remains in a nascent stage. By synthesising the existing empirical and conceptual studies, this review enriches the knowledge on the intersection between digital platforms and open innovation. One contribution of this review stands as the integration of the existing knowledge and the proposition of an integrative framework for analysing value creation dynamics via digital platforms, which can be applied to different research contexts in Study 1 and Study 2. In particular, this review presents four related research areas; from the analysis comes the identification of potential research gaps and future research avenues, which constitutes another contribution of the review.

Further, this review also offers practical implications. Innovation managers and platform firms that practise open innovation need to recognise the linkage between digital platforms and open innovation to extract the synergies of the combined effects. In addition to externally available open innovation platforms, firms can develop and use digital platforms to involve a wide range of clients, suppliers and business partners to achieve specific business goals at different stages. Importantly, managers could pay special attention to how value creation is enabled at the intersection of platform and open innovation, such as increasing the architectural openness while keeping the platform core under control, designing strategies of how complementors are encouraged to develop innovation outputs, and deciding which resources and information to share with business partners. This managerial implication is based on the assumption that the interplay between digital platforms and open innovation could proffer novel value creation opportunities.

CHAPTER 3 RESEARCH METHODOLOGY

The aim of this thesis is to understand the roles of digital platforms in value creation by conducting two independent yet connected studies. This chapter provides the logic of how the RQs raised are addressed through data collection and analysis. First, an introduction to the research philosophy and methodology in general is presented in this chapter. Second, the adopted research philosophy, approach and method are discussed, including data collection and analysis process and technique. Third, detailed explanations of the research design and strategy to justify the selected research philosophy. In short, interpretivism was adopted as the research philosophy herein. According to the aims and objectives of the two studies, inductive reasoning and abductive reasoning were employed respectively as the research approach or mode of argumentation.

3.1 Introduction

Heated debates exist in social science as regards the relationship between applied research methodologies and the viewpoint of the researchers (Saunders *et al*., 2012; Johnson and Clark, 2006; Morgan and Smircich, 1980). Such deliberation is centred on the methodological approach applied to answer different types of RQs. Before deciding on the research methodology, it is of critical importance to consider research philosophies or paradigms (Bryman, 2012). Researchers need to base their appropriate research design on three elements: the research philosophy, the research methodology and the research methods (Holden and Lynch, 2004). In particular, the research philosophy concerns the connection between the knowledge and the processes of its creation; the research methodology establishes the principles and guidelines that tie the research philosophy to

the methods used in the research; and research methods focus on specific procedures adopted to collect and analyse the data.

Because the adoption of research approaches and methodologies is contingent on the research topics (Guba and Lincoln, 1994; Tomkins and Groves, 1983), this section will detail the chosen research philosophy, the rationale behind the choice and how it fits with the research theme. Meanwhile, to link the research philosophy with the aim and objective of this thesis, it is necessary to re-establish them before further analysing the research strategy used to structure the investigation.

3.1.1 Research Context

As demonstrated and explicated in Chapter Two, digital platforms are increasingly adopted to shape the way value is created, such as open innovation models via the platform approach to develop innovative market offerings. Though ventures can use platforms to enable new ideas, market offerings and business models swiftly through experimentations and refinement (Gupta and Bose, 2019; Nambisan *et al*., 2017; Lehmann *et al*., 2022), a question mark exists regarding how digital platforms can be developed and utilised to enable firms in both service industries and manufacturing industries to reap the full benefits. Previous researchers examined the relationship between platform owners and complementors and the strategic moves each side makes to affect the value creation. However, they did not pay adequate attention to the impact of platforms on value creation dynamics by considering action possibilities or opportunities proffered by platforms to enable platform firms to pursue business development while helping firms counter the challenges. For example, considering that digital start-ups would start businesses in both nascent and established service industries to capture potential business opportunities, they

face challenges such as achieving legitimacy (Fisher *et al*., 2017) and accommodating heterogeneous customer characteristics across industries. Therefore, they find it imperative for the successful creation of new knowledge (Boeker *et al*., 2019). This is particularly relevant to early stages of platform firms that strive to align their digital resources and capabilities with customer requirements across industries.

Meanwhile, a number of researchers have already paid specific attention to how manufacturing incumbents create value through platforms (e.g., Wei *et al*., 2022; Fu *et al*., 2022; Eloranta *et al*., 2021). However, existing studies on platform-enabled service businesses launched by consumer product firms only address part of the challenges, and knowledge gaps remain over the complexities associated with incumbent firms including the digital paradox, which means investments in digital offerings do not bring the expected growth in revenue (Kohtamäki *et al*., 2020), and cognitive barriers (Volberda *et al*., 2021). As noted in Chapter Two, given that the emergent phenomenon is still less known with salient gaps to be addressed, the research focus that lies on knowledge-intensive digital ventures and consumer product firms would expand the knowledge base in the current literature and also inspire or influence practitioners on the activities they implement related to platforms and business development.

3.1.2 Research Questions

To delve into the defined problems mentioned in the preceding section, two overarching RQs are developed: *How do digital platforms enable value creation in service industries*; and *How do digital platforms enable value creation in manufacturing industries*?

To achieve a more focused analysis and explore the domain of knowledge-intensive digital ventures, the following specific RQs are developed, and the research findings will be presented in Study 1 (Chapter Four):

RQ1: *What are the affordances of innovation platforms in knowledge-intensive service providers?*

RQ2: *How do innovation platform affordances empower service providers to create value for clients?*

To achieve a more focused analysis and explore the domain of manufacturing incumbents, the following specific RQs are developed, and the research findings will be presented in Study 2 (Chapter Five):

RQ3: *What are the affordances of digital platforms in servitised manufacturers?*

RQ4: *How do platform affordances empower manufacturing firms to pursue servitisation?*

3.1.3 The Research Strategy

Research strategy is key to answering RQs in a way that is in line with the overall topic, questions and research objectives. It is influenced by the phenomenon under investigation and a set of assumptions related to the three dimensions of the research philosophy: ontology, epistemology and axiology. For instance, researchers who are more concerned with attitudes can have distinct perspectives from those who are studying facts. Although the research methodologies could not offer a conclusive answer, they are useful in guiding researchers to decide the type of evidence, the location and manner of data generation and how they are to be analysed to fulfil the research purpose, thus developing an appropriate research strategy (Easton, 2002; Easterby *et al*., 1991).

3.2 Research Philosophy

As explained in the previous sections, the topic of selecting the right research strategies to effectively approach the subject being studied is under debate, which would start with a research philosophy because researchers can have different assumptions about the knowledge and the nature of truth. Research philosophy can be known as a set of briefs and practices that guide researchers' behaviours while conducting their investigation through given lenses and frames (Weaver and Olson, 2006). The philosophy concerns three interrelated dimensions: ontological, epistemological and methodological assumptions of research (Scotland, 2012). Specifically, ontology relates to how researchers perceive the nature of reality; epistemology concerns the nature of knowledge and how to investigate the world; and the third dimension is driven by ontological and epistemological assumptions (Killam, 2013), that is, how to best collect data. The following section discusses these dimensions, including the research approaches that could be adopted to investigate the research subject.

3.2.1 Ontology

Ontological assumption is concerned with the basic nature of reality. It 'conceptualizes the form and the nature of the reality' (Guba and Lincoln, 1994, p. 108). According to Saunders *et al*. (2012), it relates to the assumptions that researchers hold about the ways the world operates, and their level of commitment to specific viewpoints. Consequently, researchers should determine the way social entities are perceived by them to identify their worldview (Bryman, 2012). In this regard, two fundamental aspects of ontology – objectivism and subjectivism – are widely used by business and management scholars to generate valid knowledge (Saunders *et al*., 2012). Alternatively, two aspects

are equally called realism and relativism. The former suggests that objects and subjects are independent of social actors and exist objectively (Killam, 2013); the latter holds that social entities are dependent on one another, and their occurrences are affected by social actions (Ittelson, 1973). As such, multiple truths or realities exist in line with the construction of reality (Sale *et al*., 2002). For researchers, their selection of the ontology based on their worldview should be congruent with the RQs (Creswell and Plano Clark, 2011).

As discussed in Chapter Two, digital platforms, the objects of this research, and their emergence, development, and how they are used for value creation by different organisations, are not taken-for-granted realities. More precisely, platforms are the outcomes of social processes and interaction. Thus, having an enriched understanding of technologies or information systems (i.e., platforms) necessitates understanding 'the context of the information systems, and the process whereby the information system influences and is influenced by the context' (Walsham, 1993, pp. 4–5). The following section discusses epistemology and determines the epistemological stance that suits the chosen ontology for this thesis.

3.2.2 Epistemology

Epistemology is concerned with the form and nature of knowledge, what constitutes valid knowledge and how the researchers interact with the objects being studied (Saunders *et al*., 2012, Orlikowki and Baroudi, 1991). Based on the ontological assumption that researchers assume, they would adopt appropriate epistemological assumptions. As Becker and Niehaves (2007) pointed out, if researchers recognise that 'objective cognition of an independent reality is possible' (p. 203), they are more likely to deploy a positivist epistemology position; and those who perceive objects as constructs contingent on human

consciousness and interpretation have a high likelihood of adopting an interpretivist epistemological position. Positivism and interpretivism represent two primary philosophical perspectives, located at opposite ends of the philosophical spectrum

Positivist Position

A researcher with a positivist orientation believes that realities are 'out there' in the world, can be measured through conventional scientific methodologies (Bassey, 1995) and are not influenced by researchers to produce valid knowledge (i.e., objective ontology). Therefore, the positivist researchers would use value-free instruments and quantifiable measures (i.e., variance theories) to test a theory to enrich the predictive or explanatory knowledge and understanding of the phenomena. To build their theories, a positivist researcher develops propositions or hypotheses that explain and reflect the research subject through exploring independent and dependent variables, as well as their relationships with one another. In other words, they follow the rule of hypothetico-deductive logic based on the manipulation of theoretical propositions and testability of theories. Lee (1991) argued that a positivist research approach should meet four requirements: falsifiability, logical consistency, relative explanatory power and survival of empirical analysis that falsifies the theory. For the first requirement, falsifiability (dis)confirms the truthfulness of proposed theories in various research contexts (e.g., closed innovation versus open innovation), and logic consistency means that developed hypotheses of a theory are logically deducted or instructed by previous literature. The relative explanatory power refers to the degree to which a theory is capable of predicting or explaining the subject in a controlled research setting, whereas survival requires a theory that is falsifiable, consistent and explanatory to be verified through disconfirmation efforts in empirical tests.

Interpretivism Position

A researcher with an interpretivist orientation holds the view that realities, namely, subjective ontology, and valid knowledge are products of social constructions, which is inseparable from the involvement of the researchers in the process of sense-making (Orlikowski and Baroudi, 1991). Epistemologically, Rosen (1991) has highlighted 'getting inside the world of those generating it, and constructing an interpretation of other people's constructions' (p. 8) to generate knowledge. That is to say, researchers need to contextualise and immerse themselves in the empirical settings to comprehend the meanings (co-)created with the research participants. This also requires the researchers to have a good knowledge of the language of the target organisations or individuals to understand 'how practices and meanings are formed and informed by language and tacit norms shared by humans working toward shared goals' (Orlikowski and Baroudi, 1991, p. 14). Besides, an interpretivist position suggests that the reality be understood through studying those individuals or phenomena, and one can reasonably assume that there is no single reality (Kirkwood and Campbell-Hunt, 2007).

From this viewpoint, constructs such as digital platforms and value creation in the form of market offering development cannot be studied as 'wholly objective phenomena' (Magalhães, 2004, p. 10). Rather, they are perceived as the outcome of collective actions of focal firms, customers and other business partners. In a similar vein, based on the tenet of the affordance theory, platforms and digital technologies need to be understood not as merely material artefacts but rather as the result of human perceptions around the activities from using these artefacts. In this regard, interpretivism demonstrates its suitability to this

thesis because the evaluation of human actions, behaviours, and interactions is required to study the phenomenon of interest (Saunders *et al*., 2012).

RQs in this thesis were answered by adopting the (inter)subjective and interpretive approach by means of conducting text interpretation of both primary and secondary data. In doing so, understanding was derived from subjective and intersubjective interpretations. Subjective interpretation is adopted to generate knowledge primarily from secondary sources (e.g., annual reviews), whereas intersubjective interpretation is jointly developed with the interviewees in the areas of business, strategies (i.e., business expansion), platform development, and how value creation activities are practised based on the platforms. For example, in the process of interviews the researcher played the part of devil's advocate through putting forward an alternative interpretation about value creation-related events (i.e., product or service innovation) or their adopted strategy (e.g., servitisation strategy) with the research participants. As a result, intersubjective interpretations and meanings were developed to derive knowledge.

3.3 Adopted Research Methodology

3.3.1 Qualitative Research

To conduct a valid investigation to explore and understand complex situations or problems, researchers are expected to have their research design ready and adopt specific techniques to gather and analyse the data. These decisions need to be included in the research strategy and congruent with the research purpose (Easterby *et al*., 2008). To address the RQs and fulfil the research purpose, a multi-qualitative research approach is preferred. Qualitative research is needed to 'discover reasons for observed patterns, especially the invisible and surprising ones' (Busetto *et al*., 2020, p. 1). Although there are

various types of qualitative research, such as case studies and interpretive field studies, when new concepts emerge, exploratory studies along with case study research are deemed appropriate in several management disciplines (Goffin *et al*., 2019).

Research Method: Case Study

An interpretive multiple case study is used for this thesis to explore the value creation mechanisms on platforms (Walsham, 1995; Yin, 2009). To this end, the thesis embraces an exploratory approach in Study 1 and prescriptive approach in Study 2 (Gregor, 2006) by synthesising focal concepts from the digital platform literature, strategic management and innovation management to design an analytical approach for identifying (1) affordances of studied platforms, and (2) affordance evolution or actualisations that lead to desired outcomes. It is contended that the interplay between platform and affordances creates favourable conditions for (3) value creation. If successful, organisations would follow that path to further enhance their relationship for greater value creation.

Specifically, this thesis argues that digital platforms are developed and implemented by focal firms to create value for themselves and clients based on the organisational goals. The interplay among platform, focal firms and platform stakeholders could create novel value creation logics within innovation ecosystems, which are increasingly valued by firms when the locus of innovations moves from closed innovation to open collaborative innovation enabled by platforms that are atypical to prior innovation practices enacted by firms only treating information systems as operand resources. However, given the complexity and nascent stage of value creation on digital platforms, multiple case studies were used as the research method because multiple case studies can

not only address ‘how’ and ‘why’ questions in nebulous and complex research contexts (Dubé *et al*., 2003; Yin, 2009), but also increase the validity of research compared to a single case study. Because this thesis strives to enrich the knowledge of how digital platform firms can evolve their platforms towards creating more opportunities to enable or facilitate value creation, the case study approach is deemed appropriate for disentangling the interplay among digital platforms, focal firms as agentic actors and value creation dynamics. Given the complexity of the platform ecosystems, the research targets herein are platform owners/operators providing knowledge-intensive business services such as technology providers to their business customers in Study 1 and developing new innovative service business by consumer product firms in Study 2. Below details the case selection process.

Case Selection

For Study 1, the empirical setting was knowledge-intensive service providers, focusing on SMEs across diverse sectors. These companies were selected as the focus of the research because current platform literature largely explores well established platforms from large platform organisations. Compared with large companies, SMEs tend to possess limited resources and capabilities. How SMEs manage open collaborative innovation on platforms provides an appropriate context to explore its early stage of platform development as they strive to create enhanced value in this process. Moreover, the selected cases operate innovation platforms, showing the logic of innovation leverage to strive for economies of innovation and complementarity (Thomas *et al*., 2014). They also provide knowledge-intensive services to their business customers, which also imply the necessity

of relying on external sources of knowledge and resources to create more innovative and customised solutions to conform to diverse customer needs across industries.

The researcher depended on purposeful case selections to learn from the cases in diverse sectors to achieve maximum variation (Denzin and Lincoln, 2011). To yield similar results, literal replication logic was adopted to purposefully selected case firms (Paré, 2004). The cases shared several common characteristics in terms of the type of platform, relevance of digital platforms to their product offerings, and ownership. They were all B2B firms that emphasised the strategic role of their platforms to collect customers' input and build relationships. Specifically, innovation platforms are launched to develop solutions while serving as a mediating tool to engage with their enterprise customers, a strategy that leads to open collaborative innovation of desired offerings. Moreover, all cases had the record of winning major industry awards, and possessed substantial experiences and expertise in providing innovative solutions in their industry, enhancing their representative of the selected platform firms.

In addition to their commonalities, the researcher sought to access a sample of organisations that are diverse in terms of sectors (e.g., chemistry and digital marketing), firm age, and degree of platform maturity, and the complexities of platforms. For instance, the platforms in case firms ranged from self-built platform infrastructure to software-as-a-service (SaaS) platforms in combination with disruptive technologies (e.g., AI and big data). The maturity of platform is also taken into consideration to ensure that the researcher could have sufficient data on platform development and related activities. Specifically, archival data (e.g., news and internal documents) was reviewed to evaluate the six platforms to confirm they were at different growth levels of platform development, as indicated by their

scalable and established platform-based business models, thus filling conceptual categories (Eisenhardt, 1989).

Specifically, Study 1 started with one knowledge-intensive service provider that develops solutions in the chemistry industry. After the researcher successfully conducted one case study, the respondent was asked to introduce digital platform firms that met the selection criteria. This approach is more acceptable in a Chinese context because respondents could be more cooperative in terms of knowledge sharing when there was some connection or social tie (Huang *et al*., 2008). Consequently, the researcher obtained access to six innovation platform firms that represented diverse sectors, namely chemistry, business intelligence (BI), marketing, construction, low-code application platform tools and enterprise software for commerce and trade. The reason for selecting the diverse business sectors is that selected cases in these sectors would serve business customers across industries to expand their business scope. It was thus expected that case firms would engage intensively in collaborative innovation activities to conform to needs of business customers. Therefore, the diverse sectors provide an opportunity to analyse the cases for their commonalities and differences and to discover platform-mediated open collaborative innovation that was not firm or sector specific. This approach, therefore, increased the generalisability of the findings (Paré, 2004). Besides, the completeness of the study is ensured with six cases; no novel findings were gleaned from further interviews (Corbin and Strauss, 2015; Eisenhardt, 1989).

Case Description

Company A is a data-driven material development platform firm. The core value of the firm is that the combination of artificial intelligence (AI) and material fields could

transform the way new formulas or new material are developed. As the company keeps adding new functionalities onto the platform, there might be business opportunities emerging along the way, such as connecting material suppliers and users followed by the introduction of reverse prediction of a chemical synthesis pathway. Company B is a platform firm offering platform-based products to provide BI to its clients and help them with digital transformation. As more attention is paid to data management in the market, Company B responded to develop its portal into an applications management framework. Based on this framework, the firm can create many data applications for client companies. Company C is a marketing solution provider through its SaaS platform. Leveraging its power in AI, Company C is capable to develop and implement AI algorithms, distinctive in the domain of AI and algorithms. Its 5A full-link marketing model is a new model designed to break the customer acquisition boundary, a process that starts with the promotion of brand awareness among a wide variety of customers, before focusing on certain types of customers. Company D is also a SaaS platform for project management in the construction industry. The company is the client of Company E, and its SaaS platform is based on low-code platforms. Given the limited data access of their collaborative innovation, these two Companies were explored separately. This makes sense because Company E provides its Platform as a Service (PaaS) and SaaS technologies, upon which Company D develops its own platform. Besides, its SaaS platform means that there is no need for the company to purchase IT investments (e.g., network connectivity, servers and device hardware), the digital start-up can devote more resources to industrial pain points and customer needs. Company E is a low-code application platform provider. Low-code development is an effective approach to bridge the gap between limited IT investments and

a growing number of tasks for the IT department. Company E has helped SaaS enterprises, consulting companies and customers significantly reduce response time and cost in complex business scenarios. Its management team continuously expands the platform ecosystem, exemplified by their recent collaboration with PwC to expand the business in financing industries. Company F is a SaaS platform firm that provides digital services to small and micro businesses, especially in the commerce and trade circulation industry. On its platform, self-developed products were rolled out; they constitute the subsystems of their platform, which in turn allows the data connection among these subsystems to create new product offerings. Table 3.1 illustrates the role of platforms and their descriptive information of case firms.

Table 3.1: Descriptive Information of Case Firms for Study 1

Case	Founding time	Selling point	Main products/services	Role of innovation platforms
Company A	2017	A data-driven new material development platform firm	Material data-related services and software development, industrial analysis and consulting; hardware is also included	Platform-based offerings and a digital tool for value (co)-creation to expand the reach and scope of the platforms and their offerings
Company B	2008	A platform firm offering platform-based products to provide business intelligence to its clients	DataCVG intelligent management platform, data governance platform and intelligent collection platform, web intelligence platform etc. and SaaS products	
Company C	2015	An AI-driven 5A full-link marketing solution provider	SaaS marketing platform and digital marketing services. Other IT services are provided, including cloud computing and other types of platforms	
Company D	2019	A SaaS platform for project management in	A SaaS platform for project management in the construction	

		the construction industry	industry, targeting subcontracting enterprises that carry out construction	
Company E	2017	A low-code development platform	Interrelated products: aPaaS (application platform as a service), iPaaS (integration platform as a service), and hPaaS (high performance platform as a service) for differing needs	
Company F	2014	An enterprise software-related IT solution provider	Purchase-sales-inventory management systems, enterprise resource planning (ERP), business intelligence (BI) and shopping management systems and social customer relationship management (SCRM)	

Case Selection

For Study 2, the research setting was the servitised consumer product firms across sectors. Given the limited progress and adoption of B2C servitisation in the industry (Kreye and van Donk, 2021), the researcher employed the purposeful sampling and selected companies if they fulfilled the following three selection criteria (Palinkas *et al*., 2015; Yin, 2009): (1) the company needs to be a consumer product company, manufacturing products to individual consumers; (2) the company has demonstrated an established position within its industry; and (3) the company has to have started the servitisation two or more years ago to avoid pilot or small-scale servitisation attempts and to sufficiently inform the research. Overall, the selected companies are consumer product firms that implement the servitisation strategy as an important component of business models and revenue streams. Table 3.2 gives a brief overview of the selected cases, including the founding year, the industry, and number of employees.

Table 3.2: Overview of Case Firms for Study 2

Case firm	Founding	Sectors	No. of employees
Company 1	2002	Ergonomic products	4000
Company 2	1968	Household appliances	165,800
Company 3	2007	Tailored outfit	3000
Company 4	1997	Automobile	50,000
Company 5	1984	Information and communication technologies	71,500
Company 6	1996	Intelligent kitchen appliances	16,000

The description of six case companies is as follows. Company 1 is distinguished from traditional furniture providers in that it designs and provides ergonomic solutions, aspiring to support users' wellness and productivity. To facilitate overseas commerce, Company 1 made investments in oversea warehouses and its own online marketplace platform to support self-operated business. To reap the full benefits from its assets and expand the revenue streams, it has gradually served corporate customers, which has considerably increased the proportion of service offerings in its overall portfolio. Company 2 is a renowned household appliance manufacturer both at home and abroad. It is the only Chinese home appliance manufacturer listed in the Global *Fortune* 500 Companies since 2016. Due to the highly competitive landscape in which it operates, the company supplies diversified and high-quality products and services, such as heating ventilating and air conditioning systems, household appliances, industrial automation systems and robotics, as well as smart supply chains (e.g., logistics). Having recognised the importance of digital technologies, the company has pursued large-scale digital transformation since 2013, and extended its traditional businesses to high-tech businesses, including the application of smart robots, sensors and AI. Company 3 provides customised apparel to global markets.

To leverage the platform's value and navigate opportunities and threats in its industry, the company innovated through production process reconfiguration and shifted from mass production to mass customisation. The company pays special attention to collaborative innovation efforts with technology suppliers, working together to design and develop its digital assembly line and IoT devices that connect products, machines, and human workers seamlessly (Tian *et al*., 2021a). Company 4 is an automobile manufacturer and has built strategic partnerships with other car brands to create innovation capabilities (Yakob *et al*., 2018). Nowadays, to capture new business growth points for traditional automobile enterprise, the company is exploring the 'big travel' market and pursuing service-oriented transformation through providing the car-on-demand service on the digital platform, which can also serve business customers. In addition, it has leveraged digital platforms and app development to better connect with its customers to enhance customer loyalty. Company 5 is a global firm offering ICT-related hardware and software services. Nowadays, the company is on the Global *Fortune* 500 list as a renowned consumer brand and operates in more than 60 countries (Feng and Yu, 2021). Because the company has extensive experience and resources in manufacturing and supply chain, such as factories and supply chain partners on a global scale, Company 5 has leveraged digital platforms to connect these resources and capabilities to serve business customers. Finally, Company 6 is the most well-known Chinese brand in the kitchen appliance industry. Though in comparison with the aforementioned cases, Company 6 is relatively lagging behind in service provision, it is now devoting considerable efforts to providing customers with a wide range of services. For example, it explores value creation opportunities related to its business. Because it

provides kitchen appliances, services in areas of gourmet cooking, home decoration, health and wellness are introduced to customers.

3.4 Multiple Methods of Data Collection

Considering the subject being studied and data availability, this thesis adopted a combination of multiple qualitative methods (e.g., interviews and focus group), in other words, multimethod research was adopted in this research (Silverman, 2020) to explore the contingency and multiplicity of the social entities (Moran-Ellis *et al*., 2006). Deploying various sources of data on the basis of the same epistemological position (Justesen and Mik-Meyer, 2012) can play a part in enhancing the research quality, because different sources of data lay the foundation to dig into the nuances and different perspectives (Tierney *et al*., 2019; Essén and Sauder, 2017). Frederiksen *et al*. (2014) argued that different qualitative methods allow for the creation of knowledge, which may be inaccessible or invisible to researchers. As such, one can appreciate why researchers regard 'research designs that include multiple research strategies [as] the strongest ones' (Esterberg, 2002, p. 37).

In particular, the modes of data collection for this thesis are in two forms: primary (semi-structured interviews) and secondary data (news, and firm documents). Regarding semi-structured interviews, the interview questions (see Appendix A and Appendix B) were developed from the literature review pointing to the value creation and innovations on digital platforms, and then potential questions were narrowed down towards the RQs. During this process, specific attention was paid to how digital platforms emerge and develop, the roles of different platform stakeholders and activities platform firms engage in along with the outcomes. Semi-structured interviews, compared with other types of

interviews, have the merit of enabling the researchers to collect publicly inaccessible data and additional insights that may further enrich the study. Informal interviews took place during conversations when the researchers attended online and offline sharing sessions. These informal conversations and ad hoc interviews provided opportunities for the researcher to establish a strong sense of trust with the informants. This trust allowed the informants to freely share information and express their opinions (Schultze, 2000). Therefore, informal interviews conducted in naturalistic settings can be valuable for capturing interviewees' narratives regarding platform development, ultimately enhancing the findings of the study (Swain and King, 2022).

Explicitly, the researcher was interested in gleaning insights into opportunities emerging from platforms that create conditions for value creation over time. Semi-structured interviews were conducted in target companies located in China for ease of data collection. In terms of interview partners, the research started with a pilot study in organisations that have built relationships with the university, and the researcher asked respondents to introduce potential firms that meet the selection criteria. Within each firm, the researcher solicited interview partners, namely, senior managers across departments who are knowledgeable in regard to platforms and business. In total, 24 interviews with knowledge-intensive service providers were conducted for Study 1 and 29 interviews with established consumer product firms were conducted for Study 2. To complement the primary data set and triangulate the tentative findings, the researcher collected documents (e.g., secondary interviews) and news (e.g., press releases) that were publicly available, along with firms' confidential documents provided by respondents. The researcher also tried to expand the data sources, including news published by the Enterprise WeChat

account and other WeChat accounts, with its authenticity verified by interviewees. These additional materials provided further clarification to data collected during the interviews. Table 3.3 and Table 3.4 summarise the data sources for Study 1 and Study 2.

Table 3.3: Primary and Informal Data Sources for Study 1

Source	**Company A**	**Company B**	**Company C**	**Company D**	**Company E**	**Company F**	**Total**
Formal interviews	2	3	2	2	2	1	**12**
Duration of formal interviews	140 mins	310 mins	105 mins	125 mins	135 mins	80 mins	**895 mins**
Informal interviews	2	2	1	3	3	1	**12**
Key informants	General manager, database operation engineer	Marketing manager	CEO	CEO, chief information officer	Marketing specialist, 2 ecosystem managers	Product manager	
Informal data sources							
Firm documents (e.g., product introduction handouts, company introduction and solution development strategies) and content (e.g., news and events) published on WeChat enterprise accounts, official website and other documents available online (e.g., secondary interviews) Informal interviews (e.g., WeChat, workshops)							

Table 3.4: Primary and Informal Data Sources for Study 2

Source	**Company 1**	**Company 2**	**Company 3**	**Company 4**	**Company 5**	**Company 6**	**Company 7**	**Total**
Formal interviews	6	2	2	3	2	2	1	**18**
Duration of formal interviews	357 mins	130 mins	92 mins	163 mins	160 mins	90 mins	70 mins	**1062 mins**
Informal interviews	6	1	1	1	n.a.	1	1	**11**
Key informants	Chief information officers, managers in information department	General manager in one business unit; R&D engineer	General manager of smart engineering system	Chief operating officer (COO); chief information officer (CIO)	Global supply chain digital transformation officer (DTO); gobal supply chain risk management committee (RMC) manager	Product engineering manager	Marketing manager	
	Informal data sources							
Firm documents (e.g., product introduction handouts, company introduction and solution development strategies) and content (e.g., news and events) published on WeChat enterprise accounts, official website and other documents available online (e.g., secondary interviews) Informal interviews (e.g., WeChat, online forum).								

Besides, to minimise retrospective bias, specific events were identified in the platform development and business expansion process (Miller and Salkind, 2002). Moreover, the tentative findings of Study 1 were presented and discussed in the sharing session organised by Company E and more information was collected from the organised focus group. Similarly, the findings of Study 2 were also presented in a conference with my interviewees from case firms to avoid bias (Yin, 2009), and to enhance the findings. In the conference, the researcher had the opportunity to gather feedback, including input from other professionals in the manufacturing industry, to assess the generalisability of the findings based on their collective experience. In so doing, the research bias can also be minimised by respondent validation (Robert *et al*., 2006). Moreover, this form of data collection alongside the data sources mentioned above enable data triangulation (Golafshani, 2005). Reliability and validity of data collection can further be ensured through the transparent research process that the researcher has strived for, including keeping a research diary which documents the decision trail (Robert *et al*., 2006).

3.5 Data Analysis: Theoretical Thematic Analysis

Qualitative data analysis can be described as a spiral process because the researchers may go through the data several times before reaching the research output (Creswell, 2007). Besides, there is no general formula for qualitative data analysis; the method used is contingent on the collected data and the research purpose (Saunders *et al*., 2015). Data analysis consists of a multitude of key components, which require researchers to organise the dataset, get acquainted with its contents, classify and code the data, interpret the findings, as well as present and document the results (Rowley, 2012). Researchers

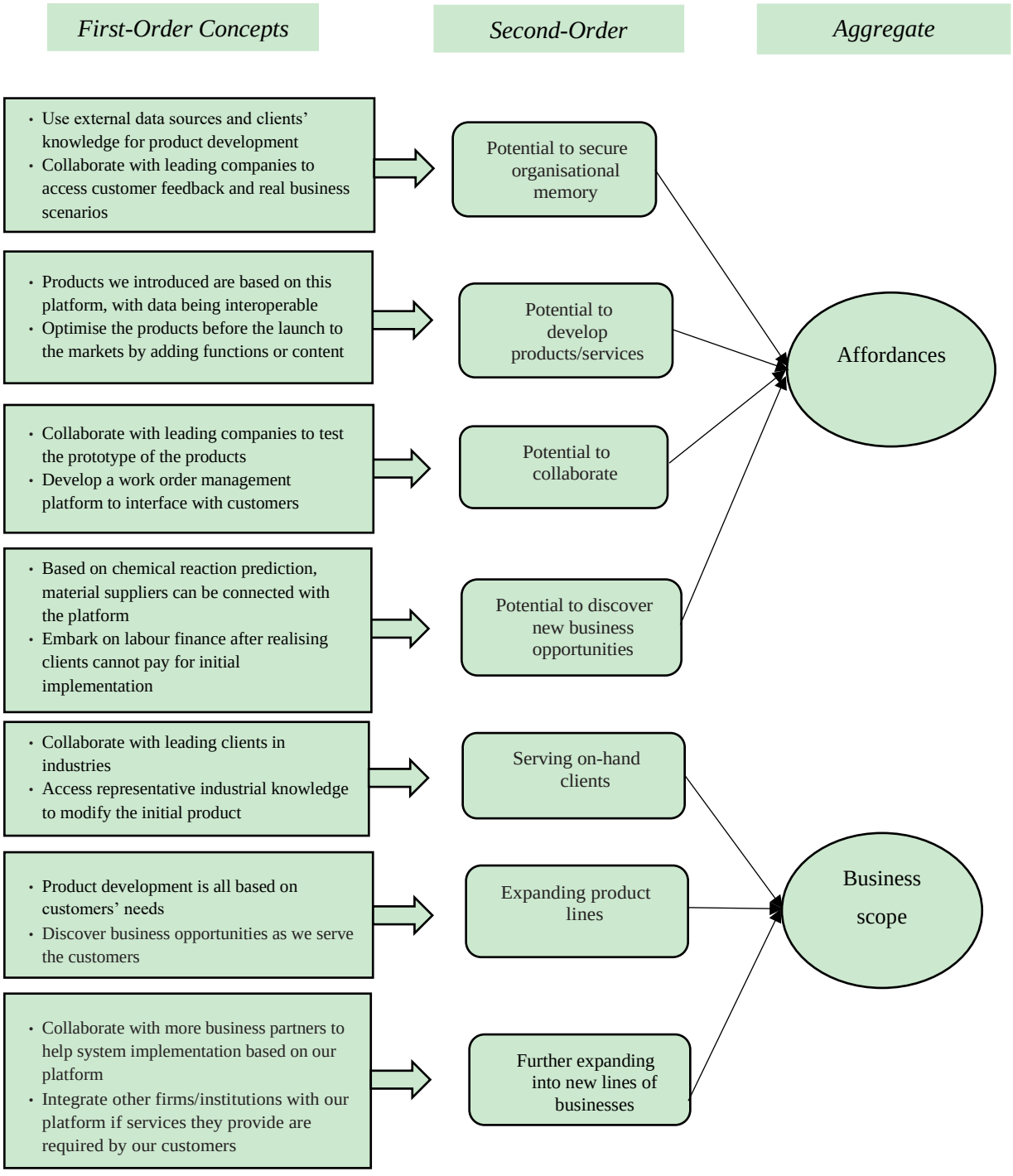
focusing on the meaning of the collected data and establishing the key themes is at the core of this analysis process.

Thematic analysis, due to its advantage of identifying patterns in massive and complex datasets (Braun and Clarke, 2006), has been frequently adopted for qualitative data analysis. As Braun and Clarke (2006) stressed, 'thematic analysis provides a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex account of data' (p. 82). In practice, numerous researchers applying thematic analysis have pointed out that there is no agreed-upon standard for conducting analysis in the correct or incorrect manner (Vaismoradi *et al*., 2016, Tuckett, 2005, Saldaña, 2013). The analysis of the qualitative data was performed herein by using the six phases of Braun and Clarke's (2006, 2013) to conduct thematic analysis. The six-phase procedure involves getting familiar with the dataset, developing initial codes, identifying themes, reviewing and refining themes, defining and labelling themes, and finally, generating the final report. This method offers techniques for researchers to find, report and link analytical themes. According to Boyatzis (1998), a theme is the fundamental segment or element of raw data or information that can be evaluated in a significant manner with respect to a particular phenomenon. Therefore, themes enable researchers to address the RQs through organising groups of repeating ideas (Vaismoradi *et al*., 2016).

How data are analysed depends on the analysis type, that is, inductive or theoretical thematic analysis. Inductive thematic analysis is data driven, using line-by-line coding (i.e., bottom-up approach), whereas the theoretical thematic analysis is a top-down approach. Researchers do not code every line of text, and the process is guided by theory or concepts. For this study, an inductive thematic method was used to analyse empirical data to identify

relevant patterns and themes (Braun and Clarke, 2006). Segments of data were organised into first-order categories and subsequently grouped into second-order themes, which were subsumed into aggregate dimensions (Gioia *et al*., 2012). Figure 3.1 represents the data structure of Study 1. Table 3.5 provides some quotations to show how the first-order concepts were identified.

Figure 3.1: Data Structure of Study 1



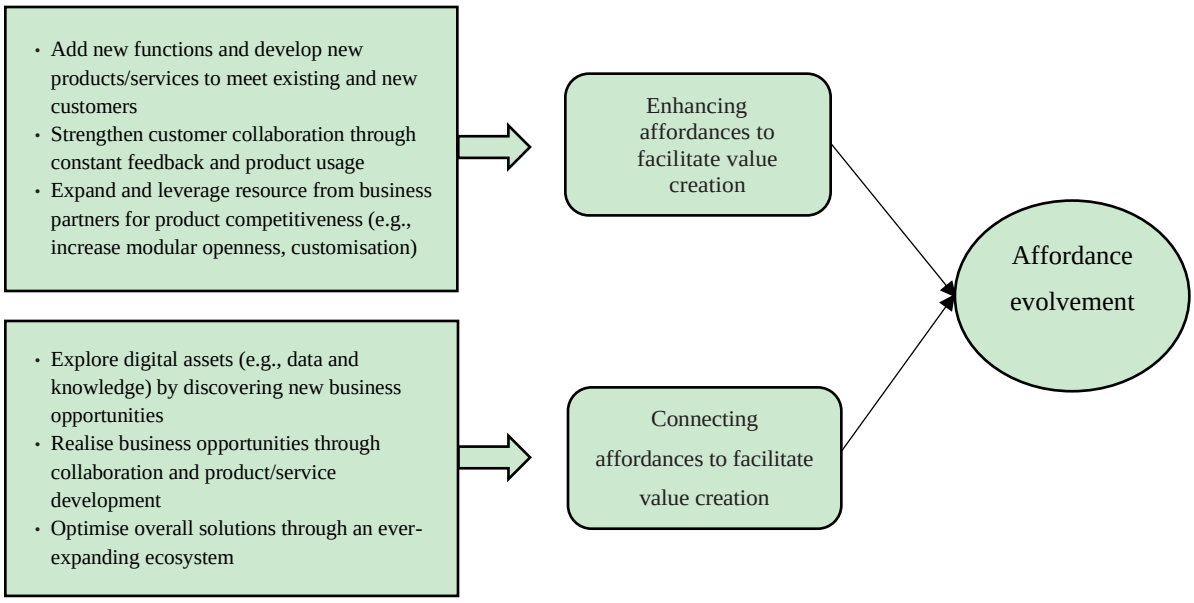

• Add new functions and develop new products/services to meet existing and new customers
• Strengthen customer collaboration through constant feedback and product usage
• Expand and leverage resource from business partners for product competitiveness (e.g., increase modular openness, customisation)
• Explore digital assets (e.g., data and knowledge) by discovering new business opportunities
• Realise business opportunities through collaboration and product/service development
• Optimise overall solutions through an ever-expanding ecosystem
Enhancing affordances to facilitate value creation
Connecting affordances to facilitate value creation
Affordance evolvement

Table 3.5: Supportive Quotations for Data Structure

Dimensions and themes	First-Order Codes and Representative Quotations
Platform affordances	
Potential to secure organisational memory	We use API and SDKs to integrate with the databases and data sources to aggregate data. These structured and unstructured data combine with intelligent data processing. User profiles emerge afterwards . . . We serve many leading firms in the medical beauty industry, so we have more authoritative and objective data on this industry. Thus, we may have a deeper and more accurate understanding of the industry than many brand customers. (CEO from Company C)
Potential to develop products/services	We initially want to develop a database, and part of the data are externally public, including chemical reactions from patents, and we also extract data from journals. We first ascertain the journals in our profession fields, and extract all papers. We will use AI to do text mining and extract useful information. (General Manager from Company A)
	As the market develops, and along with its deep R&D by our product designer who is also our boss, we convert the product into a management application framework. Based on this framework, some data applications desired by enterprises can be developed. (Marketing manager from Company B)
Potential to collaborate	Initially, we have no experience, and the 1st product version was indeed flawed. The clients we focus on are benchmark enterprises and the leading clients in the industry. We can even serve them at a loss. Of course, it's best if you can keep a lid on costs. (General Manager from Company D)
Potential to discover new business opportunities	Our platform started by developing web for clients. However, web development is technical oriented, and the value created for client are limited. And developing a web system brings three to four thousand RBM per deal, which may not be able to support platform development. Meanwhile, we realise that the bigger demand behind the web development is marketing. (General Manager from Company C)
Business scope	
Serving on-hand clients	We just want to focus on the middle part, meaning that what we provide to clients would not be applied directly in their production, but we found that clients' acceptance [is low]. Not many companies have such motivations and resources to support the further development of our technology . . . Now there are enterprises, or managers with vision already, such as the biggest phosphate production enterprise in China that we collaborated with. (General manager from Company A)
Expanding product lines	When we partnered with SPDB to build the fintech community, wherein we collaborated with a block chain company. If the outcome works well, we can encapsulate block chain related technologies into our product, no matter for fraud or credibility detection, and collaborate with other potential clients in related industries. In that case, we can only need to adjust some details, since many of our

	projects we involved to co-develop solutions are benchmarks in the industry, and the practices of the clients are exemplary. (Marketing manager from Company B)
Further expanding into new lines of business	The competition of livestreaming marketing is intensive; we started by collaborating with the Ministry of Commerce and were granted permission to engage in on-air studio training and certification distribution. During this process, we have integrated a number of leading multi-channel networks and anchors to extend marketing activities for our clients. (CEO from Company C)
Affordance evolvement	
Enhancing affordances to facilitate value creation	The customer base we are currently targeting at is relatively stable, without much variation. This allows us to provide more superior services. In turn, these customers show high support to us, and is willing to have information sharing with us. The longer they use our products, the more trust we have between each other. (Product manager from company F)
	The BI product could not be developed without original data (e.g., clients' own business data, and daily operation data) being stored in their purchase-sales-inventory management systems. (Product manager from Company F)
Connecting affordances to facilitate value creation	We collaborate with the university to develop new materials, and the development outcomes can be exploited through a form of the right of use authorisation, ownership transfer or possess buyers' shares as intangible assets. (General manager from Company A)
	Some of our consulting partners in our ecosystem like Accenture and Trout & Partners, they have very good solutions, and we can put these solutions into effect. Moreover, the solutions are different based on different industries and customer segments, and our system complement consulting partners' services to meet customers' diverse needs. . . . They will recommend their clients to us as well. (Ecosystem manager from Company E)

To conduct a thematic analysis, researchers can use specialised software (e.g., NVivo) or manually examine Word documents (Rowley, 2012). Though the adoption of software may facilitate the analysis of qualitative data (Basit, 2003), the analysis was carried out by Word documents for this study. Computer software packages are used to save time and avoid the tedious manual analysis process (Winsome and Johnson, 2000); nevertheless, the pitfalls related to the packages could affect the studies in certain ways. Winsome and Johnson (2000) highlighted the potential risks of the package adoption, such as an overemphasis on quantity rather than depth of meaning, the tendency to standardise or simplify the analysis process, a focus on coding and retrieval over richer interpretive approaches, and a potential loss of engagement or connection between the researcher and the data. Software packages may not necessarily suit the research purpose (Petty *et al*., 2012) because they are designed with a given epistemology in mind (Coffey *et al*., 1996). Taking this into account and to avoid data control risk, the researcher conducted the thematic analysis manually. The generated themes will be illustrated and examined in Chapter Four and Chapter Five later.

Following an interpretivist orientation throughout the whole study, in Study 1, inductive logic was adopted because the theory was built as an emergent theory, which is the iteration with empirical data. In Study 2, abductive reasoning was adopted where both theoretical framework and case analysis co-evolve, and researchers strive to achieve a balanced exploration of the overarching theory and contextual elements (Ketokivi and Choi, 2014). If the observed phenomenon deviates from the interpretive rule (theory), a new interpretive rule (theory) is articulated that addresses the deviation (Alvesson and Karreman, 2007). The abductive approach is particularly suitable for research areas in

which different theoretical building blocks of a theory or conceptual model are studied, but their relationships are not well known (Dubois and Gadde, 2002). Besides, as Study 2 is after Study 1, the application of abductive logic fits with the second study because the researcher would inevitably use their previous knowledge and research interests in the theorisation of the new research phenomenon. In this sense, the subsequently developed theory, based on the data, may not be seen as purely inductive (Urquhart and Frenandez, 2013). Based on the abductive logic, researchers can identify relevant theories 'to observe, describe, interpret and explain [the events] within the frame of a new context' (Danermark *et al*., 2002, p. 91). In fact, compared with digital-born service providers in Study 1, Study 2 explores large, listed companies, which meant abundant secondary data could be accessed online such as their annual reports and secondary interviews. This permitted the researcher to identify different aspects of the phenomenon under consideration (Dubois and Gadde, 2002). Table 3.6 provides examples of the abductive coding process, Table 3.7 outlines the choices of research methodology, and Figure 3.2 is the research onion of this thesis.

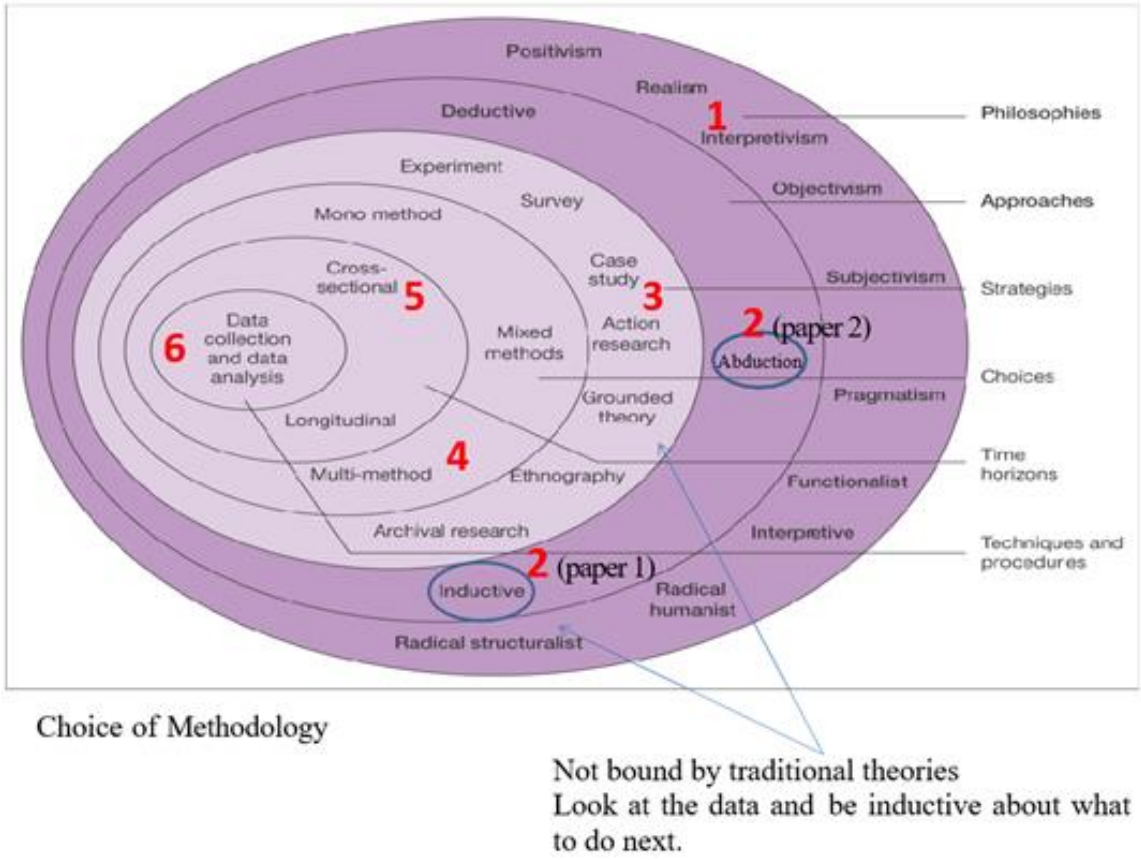
Table 3.6: Illustrative Quotes and Abductive Coding Results

Quote	Code
The setup of a real big platform must come after the process optimisation… the platform is the outcome of transformation, which merges (optimised) organizational process and business model. (General manager of Smart Engineering System -- Company 3)	**Functional affordances** Process transformation Smart product development Data-driven operation Cross-department collaboration
Our IoT team is to integrate physical goods with software, record the product data and their usage data. (IoT manager -- Company 1)	
Sales department need us to assist them with the marketing activities, including pricing activities, sales prediction. For example, how many consumers would purchase our products this double 11, which can be calculated by the system. The prediction can get us prepared, for example, in terms of staffing and equipment. (Big data platform manager -- Company 1)	
Now we have volumes of data, and we will have them sorted based on our standard and models. If we cannot handle it, we will seek for help from our business department. (Big data platform manager -- Company 1)	
We have engaged in digital business for almost five years, which mainly serve ourselves. After we have successfully incubated the digital business, the teams of the involved employees have stayed and focus on digital transformation for other enterprises. (R&D engineer -- Company 2)	**Familiarity with platform referential whole** Trainings Interact and communicate about digital platforms Change and transform behaviors
Because people all have inertia, and in terms of change management, culture and people's behaviors, we would deliver more trainings to make employees develop an awareness to change and transform (their behaviors) (R&D engineer -- Company 2)	
Half of the employees of our new supply chain and logistics business are old staff and they are more familiar with the whole business processes, and half are newly recruited, mainly with new needed skillsets…Some employees are not adaptable to the new requirement, they would drop out of our team. (Risk Management Committee manager -- Company 5)	
Til now, employees in our company would express their views towards digital platforms, including the complaints posted on enterprise social media where employees can interact and communicate with each other. (R&D engineer -- Company 2)	
When the time is ripe, we can introduce more services on the platform to sell our products and services…we pay special attention to the platform architecture so that it accommodates any changes to emergent business scenarios. (IoT manager -- Company 1)	**Exaptation: Repurpose the platforms** Flexible platform architecture
We could collaborate with business partners and create a lamp together which can be controlled by our IoT platform. (IoT manager -- Company 1)	**Relational affordances** Resource sharing and reuse New business opportunities Promote transaction opportunitie
Why purchasing the software from us is realistic and beneficial is that our company has engaged in all value chain activities, from manufacturing, production, sales, supply chain, quality management, and procurement, it has extensive experiences. The software can be more relevant to other manufacturers. (R&D engineer -- Company 2)	
We open 80% of warehousing capacity to third parties. That is, goods from these customers can be deposited in our warehouses and we can help deliver the goods for them. (IoT manager -- Company 1)	
We can put the links to agricultural products such as kiwi from Sichuan Province on our IoT smartscreen to support poverty-relief work. It is very convenient and there is even no need to change the module. (Big data platform manager -- Company 1)	

Table 3.7: Overall of the Choice of Research Methodology

Criteria	Selection
1. Philosophy	**Interpretivism** – an empiricist ontology with a dualist epistemology.
2. Approach	A combination of inductive (Study 1) and abduction (Study 2).
3. Strategy	**Multiple case studies** that adopt digital platforms (e.g., innovation platforms) to enable their business. Secondary data and archival material are collected to triangulate the findings.
4. Choice	**Multimethod qualitative data sources** (semi-structured interviews, firm documents, annual reports etc).
5. Time horizon	**Cross sectional** case studies by conducting long, retrospective interviews
6.Techniques & procedure	**Semi structured interviews** in the form of recorded transcripts as the main data source, and secondary data serve as the complementary data.

Figure 3.2: Research Onion of This Thesis



Choice of Methodology

Not bound by traditional theories
Look at the data and be inductive about what to do next.

CHAPTER 4

4.1 Introduction

Nowadays there emerges service providers to help their clients to digitally transform their business or offer digital tools to create strategic value for their clients across industries. Notably, these knowledge-intensive companies increasingly rely on digital platforms to provide solutions to their clients (van Meeteren *et al*., 2022). Such digital platforms, based on 'the (re)use of a collection of assets and the interfaces and standards that enable sharing' (Thomas *et al*., 2014, p. 206) to stimulate the development of innovative goods and services through economies of innovation and complementarity, is herein known as innovation platforms. This type of platform creates value through innovation leverage logic (Thomas *et al*., 2014). For example, Accenture developed the Accenture Insights platform to offer tools and frameworks, hence enabling collaborative development for rapid and effective customer solutions (Accenture, 2017). The firm co-develops with customers in the digital sphere and builds strategic partnerships with banking and financing system platforms to benefit from co-created development in banking and capital markets (Everest Group, 2022).

However, platform start-ups fail at an alarming rate of 90% (Brunier *et al*., 2020). The failure could be attributed to inadequate understanding of value creation in innovation platforms, which should 'deliver meaningful value to customers from uncharted space' (Brunier *et al*., 2020, p. 4). To create value for stakeholders through developing innovative products and services, it is necessary for innovation platform owners (i.e., knowledge-

intensive companies) to comprehend innovation platform dynamics because platforms at different stages may offer distinct opportunities for value generation.

Besides, as noted already, affordance literature devotes considerable research attention to transaction-driven platforms (e.g., Karahanna *et al*., 2018; Abhari *et al*., 2017; Priharsari *et al*., 2020); innovation platforms differ from these types of platforms because of their efforts on continuously accumulated innovation assets, which are controlled by platform firms and may be shared with platform stakeholders to provide customised solutions to their clients. As such, this could enable the emergence of distinct affordances that derive from the interaction between the platform and its users. Accordingly, the differences in platform goals, in tandem with corresponding platform features, result in the findings hardly being applied to innovation platforms. Based on this reasoning, here is first RQ this chapter aimed to explore: *What are the affordances of innovation platforms in knowledge-intensive service providers?*

Responding to calls in the literature, scrutinising the nuanced value creation process of innovation platform affordances, especially at the early stage of platform development is important to digital start-ups. The value creation activities would in turn play a role in stimulating platform evolution and enriching ways that platform affordances can be actualised. For instance, organisations appropriate the evolved affordances, from partial visualisation to collaborative visualisation, and then to project-wide transparency of construction objects and issues when they gradually switch from 2D models to 3D models (Gal *et al*., 2014). As digital assets on platforms accumulate over time, they bring along evolved affordances and provide novel value creation opportunities for service innovation. Despite their significance, there is a dearth of empirical studies explicating how

affordances evolve in the platform-related contexts. It is thus imperative to investigate how innovation platform affordances evolve so that platform firms may adopt appropriate tactics to activate and realise these affordances over time. Extant platform research has mostly investigated affordances through a relatively static view of how affordances emerge sequentially (Leidner *et al.*, 2018; Thapa and Sein, 2017), omitting the evolution of platform affordances and the resulting outcomes. This study attempts to address this gap by providing a dynamic view through which to examine how platform development in tandem with evolved affordances leads to value creation. Thus, the second RQ is proposed: *How do innovation platform affordances empower service providers to create value for clients?*

4.2 Theoretical Background

4.2.1 Value Creation of Innovation Platforms

Innovation platform firms have recognised the critical importance of the open innovation model. On the one hand, in the B2B context, domain knowledge about customers' pain points and segments is often not possessed by the platform firms and it is necessary for them to engage in inbound open innovation to generate new knowledge to facilitate internal innovation (Chesbrough, 2003). On the other hand, a handful of studies have emphasised the role of third-party developers in producing complementary innovation outputs. For example, Google Maps API creates maps for given locations, and its output may be tied together with other data and services to generate mashups (Weiss and Gangadharan, 2010). Such activities can be known as outbound open innovation because firms strive to transfer, exploit or commercialise the knowledge generated (Chesbrough, 2003). These two inbound and outbound open innovation form complementary connections

within value creation mechanisms whereby firms seek to collaborate with a growing number of platform stakeholders to introduce new market offerings, enhancing overall customers' value.

Besides, researchers have argued for the viability of digital platforms along with open innovation for numerous entrepreneurial opportunities (Nambisan *et al*., 2018). Accordingly, digital platforms have become a prevalent approach to unleash the potential of technologies, whereby participating firms choose a participatory mode of innovation by opening their boundaries (Alam *et al*., 2022). For example, open-source software platforms such as GitHub enable digital start-ups to have considerable opportunities to implement open-source software projects (Lin *et al*., 2021). On some innovation platforms, development tools and libraries are mapped onto distinct-use packages that evolve in tandem with the development of solution space. Consequently, both existing and new partners have leveraged these tools and can develop complementary innovations at a low cost (Nambisan and Sawhney, 2011). This assertion also explains the emergent phenomenon of innovation platforms, whereby focal firms take a lead in supporting innovation activities to provide their clients with customised solutions (e.g., Hein *et al*., 2019; Haki *et al*., 2022; Markfort *et al*., 2022). Despite the close connection between innovation platforms and open innovation, a large bulk of innovation platform literature is focused on the platform governance and architecture to promote complementors' contributions (e.g., Chen *et al*., 2021; Jacobides *et al*., 2018; Tiwana *et al*., 2010). In other words, few studies have paid attention to the intertwining roles of human agency and technology agency in reaping full benefits of open collaborative innovations on innovation platforms, leading to platform development and business expansion.

4.3 Introduction to Data Collection and Analysis

4.3.1 Data Collection

The entire data collection period lasted about two years, starting from the end of 2020 and wrapping up the collection in the middle of 2022. The researcher followed the interview protocols (Kvale and Brinkmann, 2015) to ensure a systematic data collection approach (Patton, 2002). Data for the subject were collected primarily through individual, in-depth interviews. During the interviews, data on the action possibilities offered by the platforms were gathered in a retrospective and inductive manner, enabling focused data collection (Leonard-Barton, 1990). In the interviews, subjects were guided to provide an account of the process of the platform development related to broad themes, answering questions such as, 'How has the platform developed since the company started your business?', 'How could the platform be used to develop products and/or services?' and 'What is the role of platforms in serving your customers?'. In these semi-structured interviews, respondents were given freedom to answer specific questions, thereby allowing the researcher to elicit more interesting and relevant facts (Eisenhardt, 1989).

The researcher tried to access a variety of firm-level data sources, with the main data source being formal and informal interviews. The research also obtained internal documents, marketing materials, online and offline marketing sharing sessions, and news from official websites and other public web pages to enrich the dataset. In total, the researcher conducted 12 formal interviews and 12 informal interviews (e.g., through instant messengers and workshops) from six technology firms. As mentioned in Chapter Three, these selected technology firms themselves had a history of achieving significant industry accolades and demonstrated extensive experience and expertise in delivering innovative

solutions within their respective sectors. The researcher stopped at the sixth case when the data saturation was reached, as the subsequent cases yielded redundant findings (Voss *et al*., 2002). In these case firms, the researcher was able to interview participants with more than eight years of tenure in their sectors. These participants have experienced sufficient concrete events for platform and business development, which help to ensure the representativeness of qualitative cases and data saturation. Following the recommendations of Myers and Newman (2007), all interviews were conducted in the interviewees' native language (Chinese) and were recorded and transcribed. To address potential retrospective bias and self-reporting issues in interview evidence (Gino and Pisano, 2008), The researcher triangulated the data by including firm documents, marketing sharing sessions, news from official websites, WeChat enterprise accounts and other documents (e.g., secondary interviews) available online, with their authenticity confirmed by interviewees. Table 3.3 in Chapter Three summarises the data sources.

4.3.2 Data Analysis

This study followed a three-step process for data coding and analysis (Gioia *et al*., 2013), similar strategies in recent scholarship (e.g., Fu *et al*., 2022; Sjödin *et al*., 2020). During this process, affordance theory was adopted as the 'sensitizing device' (Klein and Myers, 1999, p. 75). The first step of data analysis focused on a thorough analysis of raw material, mainly interview transcripts at this stage. The researcher read every interview on several occasions, making phrases and passages in relation to our overarching research questions. Through coding the common words, phrases, and terms mentioned by interviewees, the researcher could identify first-order categories of codes, which expressed informants' perspective using their own words. For instance, interviewee statements such

as: “ERP product is based on purchase-sales-inventory management systems, but with more functions being added and upgraded. The majority of the customers we are serving are from the commerce and trade circulation industry, but the traditional ERP is mainly for manufacturing. Given their different needs, the ERP product in our product line could be different from the conventional one” were coded under the label “add new functions and develop new products/services to meet potential new customers”.

The second step was to analyse the data to identify patterns and links within the first-order categories of codes. The iterative approach helps to form the second-order themes that are theoretically distinct concepts through combining and sorting first-order categories. As a result, second-order themes that were more abstractive than the first-order categories are identified. These themes relate to enablers and the business scope of platform-mediated value creation. In accordance with validity claims in the literature, the themes were further refined based on insights into prior literature, and data from interviews.

The third step was concerned with the development of aggregate dimensions, representing the highest level of abstraction in the coding process. Specifically, the researcher relied on literature to as a guide to form categorisations that are both practical and theoretically grounded. According to the dataset, three aggregate dimensions were constructed, which corresponded to types of innovation platform affordances and their impact on business development. The overall data structure was generated and demonstrated in Figure 3.1. Table 3.5 provides representative quotations to support data structure. Throughout the data analysis process, the researcher analysed each case, with constant discussions with the research collaborators to avoid subjective interpretation and increase validity.

4.4 Case Analysis

Case Analysis: Illustrative Innovation Platforms

Our data indicate that innovation platforms can offer four distinct affordances for value creation: organisational memory affordance, product/service development affordance, collaborative affordance and opportunity discovery affordance. Following and inspired by the work of Gawer (2021) who proposed a launch stage and a maturity stage, the researcher added an introduction stage to elucidate value creation activities before the growth-oriented launch stage in the light of this study's focus on early stage of platform development. To better differentiate between the introduction stage and launch stage, this study uses the introduction stage, growth stage, and maturity stage to describe the platform lifecycle of the case firms.

Growth stage prioritises the growth of the customer base and may waive fledgling profits to expand business; maturity stage prioritises the profit-seeking activities and leverage its dominant position such as adding new sides to better meet customer-side needs (Gawer, 2021). As mentioned earlier, Study 1 is focused on early stages of platform development, that is, an introduction stage and a growth stage and also discusses the case firms that have progressed into a maturity stage. Meanwhile, variance in the affordances was observed as value creation participants join the platforms, and driving forces were identified, serving as an indicator of the threshold of stage transition. The following sections present the findings and detail how distinct affordances emerge and enable firms to create value for customers. Table 4.1 incorporates the interview quotes, which illustrate three stages of platform-enabled value creation as platform firms progress their internal platform innovation to open collaborative innovation.

Table 4.1: Three Stages of Value Creation in Platform-Enabled Value Creation

Stage	Platform affordance	Key quotations from interviews/information from documents
Phase I: Introduction Stage	Basic organisational memory affordance	At first, we simply wanted to build a database, and we extracted and accumulated the data (e.g., formula) from all related scientific papers and publicly available patents . . . the use of big data and AI can help generate actionable information such as rules from the massive, complex, imperfect and even incorrect data and obtain valid data. (General manager – Company A) We use API and SDKs to integrate with the databases and data sources to aggregate data. These structured and unstructured data combine with intelligent data processing. User profiles emerge afterwards . . . We serve many leading firms in the medical beauty industry, so we have more authoritative and objective data on this industry. (CEO –Company C) Initially, we had no experience, and the first product version was indeed flawed . . . The clients we focus on are benchmark enterprises and the leading clients in the industry, so we can access real-time application scenarios. (CEO –Company D)
	Basic product/service development affordance	As the market develops, and along with its deep R&D by our product designer who is also our boss, we convert the product into a management application framework. Based on this framework, some data applications desired by enterprises can be developed. (Marketing manager –Company B) Our product is mainly design driven. Your products should be tested and used in industries to see whether gaps exist between our design and engineering implementation and actual demand. (Ecosystem manager –Company E)
	Basic collaborative affordance	Our platform has integrated with these channels, and they're our collaborators, meaning that we have used their resources. For example, if you'd like to run ads in TikTok, you can cooperate with us, because we have already done the data integration with them. (CEO –Company C)
	Basic opportunity discovery affordance	In the beginning, we just intended to accumulate the data, and then after it reached a certain amount, we discovered that the data could be used for computing, and the computing results could be applied for developing new materials . . . through extending the codes, we could have multiple data sources in multiple languages. (Database operation engineer –Company A) Our platform started by developing web for clients. However, web development is technically oriented, and the value created for clients is limited . . . (It) may not be enough to support platform development. Meanwhile, we realised that the bigger demand behind the web development was marketing. (CEO – Company C)
	Value creation from basic affordances	We just want to focus on the middle part, meaning that what we provide to clients would not be applied directly in their production, but we found that clients' acceptance [is low]. Not many companies have such motivations and resources to support the further development of our technology . . . now there are

		enterprises, or managers with vision already, such as the biggest phosphate production enterprise in China that we collaborated with. (General manager –Company A) If you collaborate with clients of medium to large size at the onset of your business, you will play a leading role like a lighthouse in this industry. (Ecosystem manager –Company E) The reverse prediction of [the] chemical synthesis pathway we developed is quite useful . . . Based on it, we can add the pricing of each material on the pathway and the cost of different solutions can be calculated . . . We can collaborate with suppliers to provide discounts for those who buy their product through our platform. We will consider it in the future. (General manager –Company A)
	Driving force: IT and business misalignment (digital innovation can serve more customers across industries beyond on-hand customers)	Initially, we collaborated with firms of medium and large size. However, there may have been a problem with our platform. In so doing, it will not be a highly preferred platform in the entire market. Consequently, based on our platform, we introduced SaaS versions, which can target SMEs in different industries and different application scenarios. (Ecosystem manager –Company E) Only clients use our platform to manage their operations, we can provide data-based value-added business to them. Therefore, we develop a training system, providing training such as professional knowledge and platform skills and application, and finally forming our own implementation methodologies . . . we specially organise our senior consultants to share and accumulate their experience. Certainly, we would give them some rewards. (CEO- Company D) They [employees in Solution Centre] need to collect industrial knowledge and provide more materials for product development, such as collecting the index from diverse industries, collecting analysis results from various fields and information models. Meanwhile, they need to organise project manager salons, and those project managers who are involved with profitable projects can bring their relatives in the salon activities. (Marketing manager –Company B)
Phase II: Growth Stage	Enhanced organisational memory affordance	The customer base we are currently targeting is relatively stable. This allows us to provide more superior services. In turn, these customers show high support for us and are willing to share information with us. The longer they use our products, the more trust we have between each other. (Product manager –Company F)
	Enhanced product/service development affordance	The platform is currently open, and we collaborated with some companies. So far, the development is not open to individual users or independent developers, but we will work towards this direction in the future. As long as you can write code and abide by the platform rules, you can develop some tools or complementary functions to collaborate on our platform and ameliorate our ecosystem. (Marketing manager –Company B) The BI product could not be developed without original data (e.g., clients' own business data, and daily operation data) being stored in their purchase-sales-inventory management systems. (Product manager –Company F)
	Enhanced collaborative affordance	If you use a product, especially B2B products, there should be some sentiment towards it in various degree[s], because their organisation members will use it a lot on a daily basis. There are a

	considerable number of needs being communicated with our service team and after-sales team. (Product manager –Company F) Based on the data issues of our clients, we recently launched a data governance platform . . . actually, there is a huge demand on this platform. After data are cleansed on this platform, these data can display on our DataCVG Intelligent Management Platform. (Marketing manager –Company B) We have contract terms such as joint IP and even leave the product ownership to clients if our clients require it. (Marketing manager –Company B)
Enhanced opportunity discovery affordance	One part of [the] services we provide is strategy consultation. We have served many clients in different industries, and when we help our clients with their positioning and execution, this process is backed with lots of data. In so doing, we are capable of helping clients with better operation decisions and strategic positioning and other consultation services. (CEO –Company C) Some [business opportunities] are not even from clients' feedback from product usage. When we help clients with the product implementation, we get to learn their intrafirm organisation, their management approach and some other scenarios. For example, we are now ready to embark on labour finance after discovering that they have no working capital, and they cannot sell buildings if they cannot get financial support from the banks. Hence, we are considering helping them to get funds from the banks, through which we draw a certain amount of fees. (CEO –Company D)
Value creation from enhanced affordances	Your clients will ask whether you have successfully served the customers in their industry, because different industrial models and metrics are different. If not, you have no experience with setting up the platform for your clients for their management and decision-making. (Marketing manager –Company B) We have two versions of SaaS products; the first one was to meet the needs of existing customers at that time. Its architecture is relatively inflexible. With the development of the platform and our deep understanding of clients' business, we made modifications to the architecture and developed an updated version. (Chief information officer –Company D) We have one collaborator and jointly develop BI tools. Moreover, their tools can directly integrate with our platform, and our clients can direct them on the platform. Meanwhile, we will provide them with customer feedback about the tools and more requirements, so they can update the functions of their tools. (Marketing manager –Company B) The ERP product is based on purchase-sales-inventory management systems, but with more functions being added and upgraded. Most customers we are serving are from [the] commerce and trade circulation industry, and the traditional ERP is mainly for manufacturing. Given their different needs, the ERP product in our product line is different from the conventional one. (Product manager –Company F)

	Driving force: IT and business misalignment (intrafirm digital resources may not serve expanding business)	Customised solutions may need to include algorithms and some issues, which are uncommon to the industry. Therefore, it is difficult. Considering the R&D cost, we would need to collaborate with others to guarantee the project revenue and meet clients' needs. (Marketing manager –Company B)
Phase III: Maturity Stage	Synergistic organisational memory affordance	The competition of livestreaming marketing is intensive; we started by collaborating with the Ministry of Commerce and were granted permission to engage in on-air studio training and certification distribution. During this process, we have integrated a number of leading multi-channel networks and anchors to extend marketing activities for our clients in addition to our SaaS marketing platform. (CEO –Company C)
	Synergistic product/service development affordance	Based on our consolidated core systems, we are now expanding into more applications based on the data, such as digital marketing, digital finance and taxes, and consulting services combined with products. We include third parties for collaboration, and we move towards the direction of being 'SAP' in China. (Marketing manager –Company B)
	Synergistic collaborative affordance	The upstream of the platform ecosystem includes consultation firms, new project partners . . . they would use our low code platform to build more customised business scenarios of non-standard requirements. The downstream includes ecosystem partners in charge of product and service delivery . . . Part of my job is to leverage the platform to connect the upstream and downstream and help them implement the niche application scenarios and products. (Ecosystem manager –Company F)
	Synergistic opportunity discovery affordance	If we say the industrial internet is like a forest, what we [are] prepared [for] now is to plant trees, and we need to drag every client to our platform, which is the precondition for forming an Industrial Internet . . . After future Industrial Internet businesses are developed, they might mainly rely on value-added services based on the Industrial Internet . . . for example, we have accumulated some construction resources, and if our clients cannot find projects on their own, we could provide some resources to them. (CEO –Company D)
	Value creation from synergistic affordances	We continue to develop a growing variety of applications based on data. We will include more partners in our ecosystem to jointly provide more value-added services. (Marketing manager –Company B) We will introduce insurance business to our clients in the future after their number is large enough, but we will not manage the business by ourselves because we are not expert in this aspect but would collaborate with partners in our ecosystem. (CEO –Company D) We are a technology platform company [that has] connected and will continue to connect with some ecosystems. We will not be that professional in every domain and need professional knowledge from our partners, so we can satisfy different requirements and scenarios based on this platform. (Ecosystem manager –Company F)

Phase I: Introduction Stage

The setup of innovation platforms in knowledge-intensive firms requires the possession of core knowledge by digital ventures. Therefore, case firms exploited organisational memory affordance and product/service development affordance to start their businesses after realising their knowledge combined with digital technologies (e.g., AI and big data) could convert into offerings to meet market needs. At this stage, product/service development affordance enables firms to create a product prototype and convert it into an initial product or service by developing new and desirable functions. At the focal point of the product/service development resides core knowledge to explore the value of digital technologies and emergence of platforms to produce market offerings that could fit potential market needs. Organisational memory affordance denotes that focal firms develop appropriate knowledge bases through arriving at the fit between core knowledge management teams have and codified knowledge through digital data and technologies, as well as customer knowledge through service provision. In this regard, nearly all cases use boundary resources to tap publicly accessible databases and customer data, which has implications for product and service development. This affordance was reinforced during the interviews, and all respondents stressed the importance of accumulating data to generate industrial insights.

After serving their existing customers long enough, the respondents highlighted the importance of initial explicit customer knowledge by leveraging the product/service development affordance and making the solution more appealing to meet customer needs in the target market. Because digital platforms can develop functional applications by adding modules, connecting external databases and integrating with other information

systems through boundary resources, they are conducive to building collaborative ties with business partners, enterprise customers and other institutions such as banks and government agencies. At the introduction stage, fruitful collaborative ties could be limited, and are mainly used to test product viability and value to markets based on the real business application scenarios. Collaborative affordance is, thus, understood as the IT-facilitated possibility to foster cooperation and collaboration within and across organisational boundaries with leading enterprises for initial product and service development. With the increasing amount of digital data, the fourth opportunity discovery affordance becomes more salient to platform firms, enabling them to identify new business opportunities. It is known as the IT-facilitated capability to identify unexplored value creation or business opportunities by exploring and exploiting the technological artefacts embedded within the platform. This distinct affordance can benefit focal firms to innovate their offerings, ranging from incremental improvement to their market offerings to business model innovation. For example, Company C transformed their business model from developing web for clients with limited value to its SaaS marketing platform. Almost all respondents reported the importance of the mining and coverage of business scenarios based on their existing technologies for business growth. Company A's collaboration with the automobile to put their developed smart glass materials into production.

Value Creation from Basic Affordances. At the introduction stage, four types of basic affordances can help companies provide solutions to satisfy the needs of existing clients. Developing an appropriate innovation platform in-house is a prerequisite for firms to create their products and services and realise their commercial value in the market. By collaborating with leading firms, platform firms can access feedback and customer

knowledge in real business scenarios and make modifications to their product prototype. In addition to accessing data from their clients, by leveraging boundary resources such as API and SDKs, platform firms can secure codified knowledge through platforms integrating with external databases from public or other institutions. On the one hand, serving leading business customers can help firms comprehend more representative application scenarios and industrial pain points and secure clients' industrial knowledge and feedback based on the initial usage of market offerings. On the other hand, collaborating with them helps build platform firms' reputations and legitimacy because they are generally new in their industry, and even their value creation practices are innovative and novel to the market. For example, Company A extracts data from journals and patents to develop new chemical materials using AI. In the introduction stage, opportunity discovery affordance would be actuated with increasingly accumulated IT resources. The reverse prediction of the chemical synthesis pathway was often mentioned by the respondents in Company A for the new function exploration after the firm accumulated a certain volume of digital data.

Driving Force of Progressing into the Second Growth Stage. Despite the commercial feasibility of technological innovations introduced to the market, platform firms at this stage have limited business customers. As such, they are expected to continuously expand the application scenarios supported with corresponding digital solutions and thus serve a growing customer base. Specifically, the researcher observed that case firms can serve existing clients by exploiting basic affordances, but serving existing clients is insufficient for firms to create a competitive advantage and sustain their development. The attitude and readiness of corporate clients to adopt digital products that are still nascent to customers,

can be a stumbling block for digital ventures. In addition, customers' lacking appropriate product usage capabilities, which are believed to negatively affect value creation and capture of both sides. To address this issue, case firms strive to provide new products and services to tap novel application scenarios and expand the market scope through enhancing collaborative affordance. Meanwhile, organisational design is put in place to facilitate better collaborative innovation.

For instance, Company A open partial data to encourage data sharing via its DCAIKU platform. Company B set up a Solution Centre, which specialises in micro-segments management for specific industries and sectors. The firm also transformed the aforementioned two teams into an innovation management business division and data middle platform business division in the following year. The upstream Solution Centre is to interface with customer projects, and the newly established divisions are to implement projects, and their collaboration facilitates the implementation of products and solutions in more diverse customers' business scenarios. To explore more business potentials from existing and new customers, in addition to training systems to help its clients with software implementation, Company D established a self-developed working order management platform to interface with its clients. Company E created the department of ecosystem collaboration and development and increased the number of organisational members who serve as boundary spanners, as was reported in Company F.

Phase II: Growth Stage

As digital assets and functions on innovation platforms increase, platform firms develop their capabilities and are ready to expand their business scope. Over time, along with codified knowledge from databases, because firms serve their existing customers for

an extended period, firms can secure both explicit and tacit knowledge from them. Therefore, enhanced organisational memory affordance is the IT-facilitated possibility to create, store, transform, refine, access, mobilise, apply, and exploit codified, explicit, and tacit domain knowledge.

Enhanced product/service development affordance comes into play to create digital products and services by developing new functions or solutions or recombining these components in new ways to drive economies of innovation and complementarity. Specifically, the researcher found that the core product module is matched with a growing number of peripheral product modules, which are characterised by increased modular customisation and increased modular openness with fewer modules developed solely in-house.

As firms provide complementary products to better serve their existing customers' needs, close collaborative ties can be built because complementary products are often created based on the observation of their existing customers' needs and their product usage. These products can also be used to serve new customers. In addition to collaborative innovation facilitated by relational mechanisms, wider collaborative ties are needed from contractual mechanisms to enter new markets, which was stressed by the marketing manager in Company B that customers would care whether your customers have served their business niche. Therefore, enhanced collaborative affordance is the IT-facilitated possibility to foster cooperation and collaboration within and across organisational boundaries with more clients through both contractual and relational mechanisms. Firms' deepening and widening collaborative ties create enhanced opportunities discovery affordance. In other words, firms are able to recognise potential unexplored value creation

or business opportunities by exploring and satisfying potential needs in an ever-expanding customer base. As observed, basic affordances evolve at the growth stage.

Value Creation from Enhanced Affordances. The realisation of these four enhanced affordances holds the potential for firms to provide innovative services beyond clients' expectations while expanding the market scope with exploratory initiatives. With enhanced memory affordance, firms access a growing amount of explicit and tacit knowledge. The expanding domain knowledge facilitates firms' attempts to enrich product lines and enter new business areas. Concurrently, enhanced product/service affordance can enable firms to create and provide new or advanced products and services after constant product iteration to better meet existing clients' needs and attract a new customer base, through balancing the internal and collaborative innovation.

At the growth stage, the knowledge sharing in a B2B context is driven not only by close collaborative ties, but also by clients' expectations of extracting more value by utilising more customised products based on their specific situations through feedback and dialogue. Enhanced collaborative affordance can also manifest itself through extensive customer relationships in various forms in the open innovation context, such as capital investment partnerships and joint intellectual property (IP) collaboration, on the premise that they greatly contribute to developing, delivering and implementing desired products and services to expand the market scope. Augmented inter-firm reach and range also create opportunities for firms to discover new value-adding opportunities. In this regard, a good illustration is Company F's recognition of opportunities to develop the ERP product for its target customers after perceiving the gap between their specific application needs and products on the market.

Driving Force of Progressing into the Third Maturity Stage. As firms discover new business opportunities in pursuit of growth, they find it difficult to recognise or even realise those opportunities by themselves. Specifically, firms may not have the corresponding digital assets and technological capabilities to seize the opportunities for continual service innovation. This can be evidenced by increased collaborative innovation with business partners. In Company B, as the interviewee reported "*The application of data innovation has become a key to the core competitiveness of enterprises. How to explore data technologies and put your accumulated data into innovative applications, sometimes, require us to collaborate with others to get more out of it based on users' mindsets"*. Additionally, to foster greater growth with new market offerings, Company B undertakes more diverse projects to enter a new business, whereby the firm can co-develop solutions with reduced cost and build business partnerships. The increasing number of business partners and customers sets the stage for firms to develop an open innovation ecosystem with continuous innovative services, which constitutes the core of transitioning into the following stage.

Phase III: Maturity Stage

The most challenging point in the data was firms' progression into the maturity stage because at this stage firms are required to accumulate enough clients and partners to form an emergent platform ecosystem where value creation is made possible through synergistic affordances. The data showed that Cases B, C and E have crossed the threshold of the maturity stage, and on the early stage of maturity stage. Company A, Company D and Company F are in active preparation for further platform development. Based on the practice of opening partial data to encourage data sharing via DCAIKU platform, Company

A has planned to make their platform interface more user friendly by involving more parties to design the rules and standards of data, upon which users can follow and develop their own data applications. According to the CEO in Company D, the company's practices of attracting and retaining customers and business partners can be likened to planting trees to create a forest, serving as a metaphor for the creation of an Industrial Internet Platform. Company F is open to integrating third party developers based on customers' needs and requirements to enrich user experience. Their underlying logic behind synergistic affordances is to benefit from these interactive enhanced affordances, integrating resources within the open innovation ecosystem to create continual value for the ecosystem as a whole.

As firms transition into the third phase, in addition to the rich domain knowledge, they are observed to have an increased amount of strategic knowledge that is gained from previous business activities. Accordingly, synergistic organisational memory affordance refers to the IT-facilitated potentials to create, store, transform, refine, access, mobilise, apply and exploit codified, explicit and tacit organisational knowledge associated with both domain knowledge and strategic knowledge. Such strategic knowledge combined with domain knowledge can assist firms in pursuing business opportunities, a process that necessitates the engagement of existing and new collaborators and enhances the firms' knowledge base.

As case firms develop and accumulate more strategic knowledge of market intelligence, such as target segment characteristics and emergent product expectations and market needs, product/service development affordance shifts from the goal of achieving economies of innovation and complementarity, which are mainly achieved by focal firms,

to the synergistic product/service development affordance. This affordance focuses on continual value innovation through developing or recombining new components, functions or solutions with collaboration from a growing number of business partners in firms' open innovation ecosystem.

At this stage, the enactment of the synergistic product/service development affordance is closely tied to the synergistic collaborative affordance, which is known as the IT-facilitated potential to foster cooperation and collaboration within and across organisational boundaries with clients and business partners to build an open innovation ecosystem. When firms access resources residing in the open innovation ecosystem, they activate and realise the identified business opportunities that previously may have been beyond their capabilities. The occurrence of the synergistic effects in anticipation of desired outcomes vividly explains the active preparation of Company D to enter the next level of business development. In Company D, it aims to build the industrial internet, within which it can capture the opportunity of engaging in centralised purchasing and expand its service.

Value Creation from Synergistic Affordances. Based on the foregoing, the synergistic organisational memory affordance brings firms domain knowledge and strategic knowledge, and their combination provides a guideline for future business development plans in terms of what and how product and service development can be achieved through various forms of collaboration. The synergistic collaborative affordance further converts extensive customer relationships and other business partners into an expanding open innovation ecosystem, where knowledge sharing and joint product development in pursuit of new business opportunities are made possible. Therefore, platform firms can sustain

their competitive advantage through ongoing service innovation in the expanding ecosystem. Table 4.2 summarises the case analysis, showing how affordances evolve and contribute to market offerings. Table 4.3 offers a summary of illustrative organisational practices, leading to platform affordance evolution as platforms develop over time. It is worth noting that given the platform development status of each case firm, some of the practices to synergistic affordances are their plans for enhanced value creation as more side members join the platforms.

Table 4.2: Summary of Innovation Platform Affordances, Value Creation and Affordance Evolution

Phase	Business Goal	Affordance	Definition	Value Creation Mechanism
Phase I: Introduction Stage	Provide solutions to existing clients to satisfy their needs	Basic organisational memory affordance	IT-facilitated possibility for firms to create, store, transform, refine, access, mobilise, apply and exploit codified organisational knowledge and explicit knowledge	Access external databases to extract and accumulate digital data and develop intangible yet codified knowledge to provide a tentative market offering that is far from complete and then secure clients' industrial knowledge and feedback based on the offering for product and service innovation
		Basic product/service development affordance	IT-facilitated possibility to create the first new product prototype and convert it into initial products or services by developing new and desirable functions	Develop the prototype of initial offerings to start the business and add content and functions to address basic needs of the clients on hand
		Basic collaborative affordance	IT-facilitated possibility to foster cooperation and collaboration within and across organisational boundaries with leading industrial enterprises that lead to initial product and service development	Refine and improve initial product offerings that can accommodate the basic needs of a firm's target market and build a reputation by collaborating with leading industrial enterprises
		Basic opportunity discovery affordance	IT-facilitated possibility to identify potential unexplored value creation or business opportunities by exploring and exploiting the technological artefacts embedded within the platform	Discover opportunities to add the content, components and functions to platforms to make the products more useful to a firm's existing clients
Phase II: Growth Stage	Provide innovative services beyond clients' expectations while expanding market scope with exploratory market offerings	Enhanced organisational memory affordance	IT-facilitated possibility to create, store, transform, refine, access, mobilise, apply and exploit codified, explicit and tacit domain knowledge	Access an increased amount of explicit knowledge and tacit knowledge, and develop a firm's own knowledge base to expand product lines
		Enhanced product/service development affordance	IT-facilitated possibility to create digital products and services by developing new functions or solutions, or recombining these components in new and innovative ways to drive economies of innovation and complementarity	Create and provide advanced products or services after constant product iteration to better meet existing clients' needs (e.g., satisfy their implicit needs after prolonged collaboration) and also expand their use in more diverse application scenarios to collaborate with more clients

		Enhanced collaborative affordance	IT-facilitated possibility to foster cooperation and collaboration within and across organisational boundaries with more clients in expanding industries through contractual and relational mechanisms	Develop extensive customer relationships in various forms to help with product or service development, delivery and implementation as firms seek to expand their product lines and expand the market scope
		Enhanced opportunity discovery affordance	IT-facilitated possibility to identify potential unexplored value-adding or business opportunities by exploring and satisfying potential needs in an ever-expanding customer base	Discover new value-adding opportunities to add content, components and functions through service provision based on existing products and simultaneously introduce radical innovation through new product and service development
Phase III: Maturity Stage	Developing an open innovation ecosystem with continuous innovative services provided to a large scale of clients	Synergistic organisational memory affordance	IT-facilitated possibility to create, store, transform, refine, access, mobilise, apply and exploit codified, explicit and tacit organisational knowledge associated with both domain knowledge and strategic knowledge	Expand the domain knowledge and strategic knowledge that lay a foundation for product and service development, which is stimulated by collaborative ties and emergent business opportunities for greater value creation
		Synergistic product/service development affordance	IT-facilitated possibility to create digital products and services by developing new functions or solutions, or recombining these components in new and innovative ways for continual value innovation, facilitated by an open innovation ecosystem	Create more mature and innovative products and services through the firm's expanding domain knowledge and strategic knowledge and by leveraging resources residing in a firm's open innovation ecosystem, which is either to realise new business opportunities or serve as a springboard to recognise potential opportunities
		Synergistic collaborative affordance	IT-facilitated possibility to foster cooperation and collaboration within and across organisational boundaries with an increasing number of clients and business partners in an open innovation ecosystem	Convert extensive customer relationships into an open innovation ecosystem, whereby focal firms can access and accumulate domain knowledge and strategic knowledge and conduct joint product development, thus readily enacting business opportunities
		Synergistic opportunity discovery affordance	IT-facilitated possibility to identify and realise potentially unexplored business opportunities through exploring and satisfying potential needs in an ever-expanding customer base through resource orchestration, facilitated by an open innovation ecosystem	Competitiveness can be sustained as firms become more capable of recognising and capturing new business opportunities based on their expanding domain knowledge and strategic knowledge, generating greater value from marketing offerings through platform generativity in an open innovation ecosystem

Table 4.3: Summary of Platform Affordance from Performed Organisational Practices

	Stage I: Basic affordances from internal platform development for business start-up	Stage II: Enhanced affordances from open collaborative innovation for business expansion	Stage III: Synergistic affordances from open innovation ecosystems by adding more side members
Company A	● Build a database, and extract and accumulate the data (e.g., formula) from all related scientific papers and publicly available patents ● Exploit technological capabilities and the database to work out different types of databases (e.g., semiconductor databases, phosphorous mineral databases) ● Put the developed new materials into production with potential business customers ● Explore more functionalities based on an expanding database	● Customers are more willing to share related information (e.g., production data and processes) with increased legitimacy (e.g., receiving government-guided funds) ● Make DCAIKU platform partially open to the public to show the public the value of its digital innovation and that they own such database and data processing capability to attract more customers for collaboration ● Allocation of intellectual property rights among collaborative entities depends on the level of contribution in each project and the specific sharing ratio differs in cases ● Motivate users to share their data on the platform to solve shared problems as a new operation mode	● New materials can be developed either by us or in partnership with the university and exploit the outcomes of this development in various ways, such as through the right of use authorisation, ownership transfer, or by acquiring and holding buyers' shares as intangible assets
Company B	● Accumulate experiences and knowledge from serving customers using a data portal – the prototype of its market offering ● Operate a data portal to integrate disperse data sources of the enterprises ● Convert the portal into a management application framework through in-house deep R&D led by the product designer, upon which data applications desired by enterprises can be developed	● Engage in projects across industries as a way to source external sources of data and knowledge for internal R&D ● Collaborate with business partners (e.g., companies specialising in BI reporting, blockchain technological supplier) to serve shared clients ● Expanding into more applications based on the data, such as digital marketing, digital finance and taxes, and consulting services combined with products	● Plan to establish partnerships with independent developers who can contribute tools or plugins that are compatible with the platform, enhancing the ecosystem ● Organise project manager salons, and those project managers who are involved with profitable projects share their collaborative experience with ecosystem members to develop and deliver innovative solutions

	● Introduce complementary platform products to meet customers' needs	● Attempt in consulting business along with its existing offerings.	
Company C	● Create theory innovation by introducing 5A full link marketing model and model innovation by integrating private and public traffic and data ● Integrate with leading digital channels to strengthen its service offerings ● Convert its web development platform to a marketing platform ● Introduce charged consulting service to better assist its customers in marketing-related areas	● Use accumulated experiences to drive innovation and iterative development of the platform ● Optimise algorithms based on customer acquisition costs for our clients and feedback from clients as collaborative ties are built with more clients across industries ● Collaborate with new customers and enrich its business lines, for example in the area of applications going abroad and bidding ● Introduce innovative marketing practices based on changing market trends, including approaches from marketing literature	● Integrate a number of leading Multi-Channel Network and anchors to extend marketing activities, including livestreaming marketing services for its clients through developing diverse business units ● Develop ties with service providers, including over one hundred agents in the platform ecosystem
Company D	● Initially focus on designing our products internally after visiting a couple of potential clients in the industry ● Start with product development by collaborating with Sina Youcai and jointly work on digital work in the construction industry ● Develop a standardized product ● Introduce charged consulting service to better assist its customers in digitally transforming its operations	● Develop a training system, providing training such as professional knowledge and platform skills and application, as well as forming its own implementation methodologies ● Build strategic partnerships with more giants in the industry (e.g., Nippon) and industry associations that have resources for collaborative innovation ● Establish a self-developed working order management platform to interface with its clients ● Engage in mutual learning with clients as clients may not be able to design the company's business process or know their latent needs and requirements	● Accumulate more clients and data, from which more data, from which more services can be provided, such as industrial analysis reports ● Aim for Industrial Internet Platform where external value creation participants can join the platform to provide complementary services such as Insurances

Company E	● The top management team leverages their experiences in Oracle and Salesforce to exploit the low-code application platforms in the Chinese business landscape ● Focus on product development rather than project-based delivery mode, which may hinder the exploration of innovative ideas or features ● Provide customised solutions to leading clients to build reputation ● Solve the initial pain point for its customers and then expand its usage to tackle broader problems throughout the organisations	● Increased experience in matching the needs of customers with the existing and new modules, enabling customers to benefit more from its offerings ● Leverage the platform to connect the upstream and downstream and help clients implement the niche application scenarios and products ● One main type of innovation is an incremental iterative process, whereby it involves gathering input and product requirements from customers and partners who are on the front lines ● Match customers and ecosystem members (e.g., consulting firms) to develop software on the platform	● Observe the product usage on the platform and implement continuous optimisation on features and functions ● Collect customer feedback, and weigh the urgency of module development, and its value to the ecosystems according to its strategic plan of product development ● Develop an ecosystem of components in the iPaaS domain, including more digital tools from third parties
Company F	● Prepaid research prior to product development to understand users and their needs with greater precision and efficiency ● Internal innovation of its platform and subsystems to generate synergistic benefits of customer data ● Involve more product designers to focus on the products and pay close attention to details to ensure its 'friendliness' ● Develop and introduce a mobile application, distinguishing from then competitors and specifically tailored for small and micro enterprises	● Clients are more inclined to support the development of solutions through knowledge sharing after experiencing superior services ● Collaboration with the bank for developing models such as for loan application, though the initial attempt failed because the data provided to the bank was not enough ● Sell hardware to enhance the overall competitiveness of product offerings ● Hardware and software iteration based on closer collaboration with business partners to provide users with better customer experience	● Have an annual planning process wherein various factors such as historical user demands, the perception of the industry's development direction, and strategic changes to be enacted. This annual planning sets the overall direction for the functionalities it aims to develop throughout the year ● Involve third party developers based on customers' needs and requirements to enrich user experience

CHAPTER 5

5.1 Introduction

Modern firms are straining to develop new organisational capabilities that harness affordances proffered by digital technologies to enable a wide range of business activities and to generate strategic value to their customers (Sadreddin and Chan, 2022; Hein *et al*., 2019). For manufacturers, digital servitisation is a growing trend that facilitates new business opportunities, and the proclaimed digital market opportunities may be valued at a couple of trillion dollars yearly by 2025 (Gebauer *et al*., 2020b). In this regard, researchers have paid attention to innovation platforms, such as IoT platforms or the transition of internal platforms towards more open innovation platforms (Gawer, 2014; Sandberg *et al*., 2020). For example, researchers have generally discovered that products or services open up when firms introduce digital technologies, so the platform logic could evolve from production logic to innovation logic (Thomas *et al*., 2014). Different from knowledge-intensive platform firms in B2B contexts that prioritise an innovation rationale, platforms in consumer manufacturing sectors combine multiple platform leverage logics (e.g., a transaction rationale). Types of leverage can be strengthened through integrating diverse technologies, including ERP, the social, mobile, analytics, cloud and IoT technologies (Tian *et al*. 2021a, Liu *et al*., 2023). Therefore, to distinguish from innovation platforms in Chapter Four, the term ‘digital platforms’ will be used throughout this chapter.

In addition to technological capabilities, the possibilities that digital platforms can bring to consumer product incumbents – that is, the entire process from digital transformation such as digitalising new product development to digital servitisation – have not been investigated holistically in the literature. Addressing this gap would provide

crucial insights because the implementation of more open and innovation platforms could improve firms' digitalisation efforts, which are inextricably connected to servitisation (Favoretto *et al*., 2022). Nevertheless, though digitalisation provides product firms with new opportunities for long-term competitive advantage through servitisation (Kapoor *et al*., 2021), many of them, including consumer product companies, are far from prepared to extract value from digitalisation and are more concerned with increasing efficiency rather than formulating a development agenda (Björkdahl, 2020).

Diverse firms across industries build their business activities on digital affordances to explore the value of technologies (Bharadwaj *et al*., 2013). To better understand how affordances surface to reach manufacturers' servitisation goals, it is essential to have a more enhanced knowledge of the relational aspect of affordances (Osmundsen *et al*., 2022), especially those relational affordances that are 'constructed' by users (Thapa and Sein, 2018, p. 814). Early studies have attempted to use Heideggerian thinking to supplement the affordance perspective to increase specificity and granularity. Based on this line of thought, perspectives from Heideggerian thinking may shed light on the perception and actualisation of relational affordances. The Heideggerian philosophy indicates that if we encounter entities as a present-at-hand entity rather than equipment – in other words, if we are not situated in a 'world' with a set of possibilities in interacting with equipment (Critchley and Schürmann, 2020) – we are unable to grasp the practical significance of the equipment. Put it another way, we could not benefit from such possibilities. When translated to the affordance theory, if we cannot consider the affordances in a world with shared practices and skills, even if we perceive them, we may not act on them.

Further, digital platforms now function as the backbone of products, services and operations of contemporary firms, and their widespread adoption has fuelled the dynamics of new markets, which necessitate developing necessary new organisational capabilities to capture new markets (Li and Chan, 2019). This study also considers the capabilities of the organisational actors through a process view of the affordance actualisation (Narayanan *et al*., 2009). Affordances can vary in the ease with which they are engaged with, and this can be influenced by the capabilities of the user (Mcgrenere and Ho, 2000), implying that the extent of firms benefitting from affordances is contingent on their capabilities. This also responds to the question of how the affordances that are derived from artefact–user interactions could facilitate the cultivation of new organisational capabilities in response to strategic changes.

Based on the foregoing discussion, this chapter sets out to empirically examine the roles of platforms in consumer product firms' servitisation journey by addressing the following two RQs: 'What are the affordances of digital platforms in servitised manufacturers?', 'How do platform affordances empower manufacturing firms to pursue servitisation?'. Through exploring consumer product manufacturers across sectors, this chapter responds to the call for more research on digital servitisation in consumer product firms (Paschou *et al*., 2020; Kreye and van Donk, 2021) and whether any dependencies exist among identified affordances (Strong *et al*., 2014). In other words, whether and how relational affordances could emerge in the wake of actualised functional affordances (Osmundsen *et al*., 2020).

5.2 Theoretical Background

5.2.1 Servitisation

A growing number of companies, especially industrial product companies are now altering their value creation strategies from product-oriented to customer-centric solution providers (Baines *et al*., 2009). Given its benefits to companies, customers, society and environment (Mont, 2002), servitisation has gained traction across research disciplines from different perspectives (Baines *et al*., 2009). For instance, the seminal work of Baines *et al*. (2007) presented the definitions, evolution, benefits, features, drivers and barriers associated with firms' servitisation journey. Baines *et al*. (2009) reviewed related studies from diverse research communities addressing the servitisation of manufacturing and pointed out their respective research concerns, showing their shared interest in product–service configuration. By focusing on the operations management practices in support of servitisation, Baines and Lightfoot (2013) identified six distinct practices and technologies from four industrial product companies and encouraged future researchers to identify other technologies and practices.

Meanwhile, alongside many studies examined the challenges and enablers of service transition (e.g., Mont, 2002; Gebauer, 2006; Baines *et al*., 2009), another research line considered servitisation as organisational changes and reported on it from a process perspective. For example, by examining the co-existence of basic, intermediate and complex services, Martinez *et al*. (2017) provided a longitudinal study of the actual service journeys within three firms, illustrating that their service journey was emergent and evolutionary rather than structured or logical. Likewise, Baines *et al*. (2020) explored the process of servitisation and found that multinational manufacturers undertake four phases

of maturity: exploration, engagement, expansion and exploitation, wherein the pressures of five main forces, such as organisational readiness and technology push, affect their organisational progression. Besides, despite the well-recognised benefits of servitisation, Kowalkowski *et al*. (2017) pointed out that firms initiate servitisation and deservitisation continuously, and new socio-technical systems brought about by disruptive technologies could create opportunities for service growth and the replacement of many established service providers (Spring and Araujo, 2017). In this aspect, in a thematic review, Raddats *et al*. (2019) identified five major themes and emphasised the growing significance of integrating digital technologies into the service activities of manufacturers as a prominent theme.

Servitisation also increasingly converges product-oriented industries (e.g., manufacturing firms) and the service sectors where connectivity, cloud computing and sensors function as the main enablers (Stantchev *et al*., 2015). The combined servitisation and sensors provide novel provision models in healthcare sectors (Stantchev *et al*., 2015). Similarly, digital technologies (e.g., AI) have advanced digital market offerings in banking services (Manser Payne *et al*., 2021). However, in addition to common challenges in both service and manufacturing firms, such as how and to what extent existing business practices integrate with digital technologies, and new skillsets to develop, traditional manufacturers may face challenges in transitioning to servitised firms because of their organisational identity (Kohtamäki *et al*., 2019). For example, according to Kohtamäki *et al*. (2019), the transformation of the identity from a manufacturer to a software or technology company is less explored. The new organisational identity and its activities need to be consistent,

affecting the strategic boundary activities that organisations execute, such as ‘whether to make an acquisition, enter a new market, or divest a division’ (Tripsas, 2009, p. 441).

5.2.2 Digital Servitisation on Digital Platforms

Servitisation has received renewed interest from academics and practitioners as digital technologies, such as IoT (Naik *et al*., 2020; Ardolino *et al*., 2017; Eloranta and Turunen, 2016), big data and analytics (Naik *et al*., 2020), augmented reality (Mourtzis *et al*., 2019), cloud computing technologies (Wen and Zhou, 2016) and digital platforms (Kapoor *et al*., 2021; Jovanovic *et al*., 2021; Fu *et al*., 2020; Cenamor *et al*., 2017) are increasingly adopted by companies. By converging between digitalisation and servitisation (Gebauer *et al*., 2020b), digital servitisation can be conceptualised as ‘the development of new services and/or the improvement of existing ones through the use of digital technologies’ (Paschou *et al*., 2020, p. 89). From the perspective of theory contribution in servitisation, by analysing a sample of 1,092 servitisation-related articles, Rabetino *et al*. (2018) observed that 85% ‘do not build up their theoretical framework from a grounded theory but merely combine arguments from previous servitization-related research’ (p. 361). Given that servitisation studies draw on a limited theoretical foundation (Kohtamäki *et al*., 2019; Rabetino *et al*., 2018), interpreting servitisation phenomena through theoretical perspectives could enrich the theory-building of servitisation research.

As noted, the platform leverage logics (e.g., production, innovation or transactional leverage) combined with architectural openness can enable firms to attain system-specific advantages through developing and sharing assets and systems (Thomas *et al*., 2014). This also explain the existence of both innovation platforms and transaction platforms adopted by companies, especially multi-business manufacturers. Combining different types of

platforms enables capturing more data, which combined with the technological advances such as in AI and big data, could result in a wide array of product–service applications (Cusumano *et al*., 2020). However, current literature has not paid adequate attention to their interactive effects so far. Besides, although literature review in Chapter Two has detailed the related studies that shed light on the platform approach in servitisation, there is a scarcity of empirical research on ways platforms can be adopted to generate superior outcomes of servitisation. In other words, little is known regarding how and why some manufacturers can be successful when they move towards platform-based servitisation.

5.2.3 Relational Affordance through Notions of Familiarity and Referential Whole

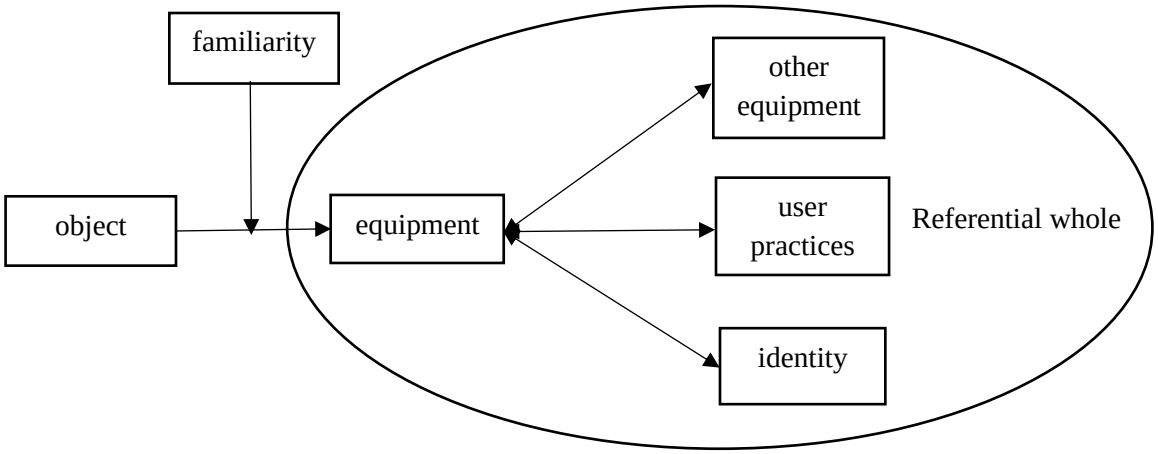
Heideggerian philosophy indicates that actors acquire a familiarity with themselves, entities, others and their interconnectedness in a world, shaping their self-understanding (Teal, 2009) and allowing them to handle equipment and situations (Turner, 2005). Actors need to have familiarity, or put another way, a background understanding, to cope with the equipment and the world in a non-deliberate and practical manner (Riemer and Johnston, 2017). Familiarity matters because it is embedded in know-how (Riemer and Johnston, 2014) and are accumulated through experience or practice in specific contexts. For example, actors depend on familiarity when they brush their teeth or play computer games, where know-how to perform the activity is not actively thought of but enacted naturally (Teal, 2009). Therefore, actors need to conduct certain learning activities to develop a deep familiarity with an artefact and for general employees, such learning would be primarily carried out in the forms of online and offline trainings and communications within the organisations. Translated to this research, familiarity is understood as organisational actors'

background understanding, engagement and involvement in platform-enabled practices in general, thus treating adopted platforms as equipment.

According to Heidegger (1962), rather than examining equipment as objects with attributes and properties, an actor encounters it as a handy or practical means: *in-order-to* (Riemer and Johnston, 2017). Equipment is thus always considered in relation to other equipment to fulfil a task (Critchley and Schürmann, 2020). A widely used example is a hammer. It does not make sense for the actor to encounter a hammer separately from other equipment such as wood and nails; rather, it is meaningful to consider it as in-order-to hammer something. The totality of equipment is constituted by three interconnected components (see Figure 5.1). First, an actor comes to understand equipment for what it is and with which it is used. Second, the actor knows for which task they use the equipment, which Heidegger refers to as the *for-which* (Riemer and Johnston, 2014, 2017): that is to say, the tasks and the character in relation to other equipment. Obviously, the nails and wood can affect the construction and the shape of the hammer (Turner, 2005). The final is *for-the-sake-of-which*, the equipment has on an actor (Riemer and Johnston, 2014, 2017). Heidegger believes that equipment is closely intertwined with an identity that an actor can assume when they perform a given activity with the use of the equipment, such as the identity of a carpenter when they are hammering the nails into wood (Turner, 2005). Translated to this research, totality refers to the referential whole of platforms, including the organisational practices (activities to enact affordances), the purposes of the practices (digital transformation and then digital servitisation) and the identity firms assume (technology-oriented companies and then customer-centric solution providers). Such a new

identity in turn makes firms engage in behaviours that are in line with it (Brown and Starkey, 2000).

Figure 5.1: Familiarity with the Referential Whole (adapted from Riemer and Johnston (2014))



A relational view of affordances makes it imperative to consider the socially constructed meaning attached to objects in a given context (Faraj and Azad, 2012; Zammuto *et al*., 2007). Taking the affordance of a post box for letter posting as an example, the affordance relies on the actor's experience and how-how of letter writing and posting as well as the ongoing maintenance and operation of the postal system (Bloomfield, *et al*., 2010). In this sense, the post box's letter posting affordance is a socialised one, differing from functional affordances such as leaning against or storage. The interaction between technology and human thus necessarily entails the 'co-presence' of other artefacts and people and should not be bounded at the individual level (Michael, 2000). This point is consistent with the Heideggerian perspective, which treats objects as *ready-to-hand*, a piece of equipment that intertwines with other equipment, user practices, the purpose and the identity. Therefore, familiarity with such a holism would help to reveal the affordance of some entities more clearly, which also facilitates their actualisation (Lanamäki *et al*., 2015).

Though users need to act on affordances to benefit from them, few studies have explored different actions that can be taken towards the same affordance with different outcomes, which may explain why the affordances may be unactualised or partly actualised despite actions taken (Volkoff and Strong, 2013). Taking commuting to work as an example, as a passenger, one might go to one's workplace by riding a train. Over time, in addition to functional affordances such as standing, walking and sitting that the train can offer, the passenger can gradually perceive that riding a train can proffer multiple relational affordances, such as working, sleeping, mediating or conversing. The passenger would recognise the significance of the sleeping if one's goal is to get to work in the most relaxed way. To leverage the sleeping affordance, one can sit on the seat and have a nap, wear a U-shaped neck pillow, put on noise-cancelling headphones or lie on the seat to sleep (if conditions permit) (Volkoff and Strong, 2013).

With all these attempts, the passenger develops the capability of exploiting the sleeping affordance and maximises the benefit from the affordance. This example shows that *what the train is* is reshaped by how they use it and also shows that familiarity expands as equipment (e.g., trains, headphones), the practices (e.g., wear a U-shaped neck pillow, put on noise-cancelling headphones) and the identity (e.g., a passenger who wants to catch up on some sleep) fundamentally co-constitute to form a holism. In fact, the extant literature has alluded to the role of familiarity in the relation between affordances and responsive actions (effective use of affordances) to have superior outcomes (Nayak *et al*., 2020). Nayak *et al*. (2020) noted that when firms interact with the environmental affordances, their sensitivity to and sufficient familiarity with affordances play a critical role in 'the repurposing of artifacts, technologies, processes, skills, organizations, and

resources for emergent uses that they were not (initially) designed for' (Dew and Sarasvathy, 2016, p. 167) and ongoing, adaptive actions to the situation at hand, which jointly lead to superior outcomes. On this foundation, it thus follows that concepts of Heideggerian thinking can provide a nuanced perspective to explain affordance perception and the actualisation process (Riemer and Johnston, 2014, 2017).

To summarise, the first-order functional affordances and their actualisation would explain how digital platforms are implemented to digitally transform the organisations, and help organisations develop a digital platform totality from a Heideggerian perspective. The second-order relational affordances derived from the digital platform totality provide a basis for realising new organisation-wide goals (e.g., digital servitisation). The enactment of the relational affordances in different practices is inseparable from repurposing organisational resources and capabilities. The aforementioned line of reasoning serves as an alternative view to understand how organisations can make their servitisation successful.

5.2.4 Affordance Actualisation and Organisational Capabilities

Given the similar nature of affordances and capabilities, neither of them are deterministic, but change in a dynamic way over time. Thapa and Zheng (2019) pointed out that on some occasions we could equate capabilities with affordances, particularly those affordances that are socialised through social practices and process (Zheng and Yu, 2016). Developing new organisational capabilities matters in the context of platform-enabled servitsation because investing in digital platforms does not necessarily lead to success and guarantee desired outcomes (Cusumano, 2020). Organisations can only generate long-term value by integrating digital platforms into organisational capabilities (Grover and Kohli, 2012). Despite the multiple definitions that exist, this research follows Story *et al*. (2017),

defining capabilities as ‘socially complex, combinations of interconnected resources that are deployed to achieve a desired end goal’ (p. 56). Based on the resource-based view, organisational capabilities can also be known as an organisation’s capacity to conceive, execute, and leverage its resources to reach a desired end (Amit and Schomaker, 1993; Mata *et al*., 1995). These capabilities not only result in a competitive advantage (Teece and Pisano, 1994), but also directly link to firm performance (Mithas *et al*., 2011, 2012).

In line with Nayak *et al*. (2020), a non-cognitivist understanding fits with interrelatedness between relational affordances and organisational capabilities. Specifically, it can be reasonably assumed that because organisational actors develop a deep familiarity with platform totality, this increases their sensitivity to latent and constructed affordances, which often co-present with other resources and people. Organisations could benefit from such affordances through skilled adaptive actions, providing a micro-foundational substrate of organisational capabilities (Nayak *et al*, 2020). By conducting a multiple case study approach, Sadreddin and Chan (2022) considered organisational capabilities as immediate concrete outcomes from affordance actualisation. According to Thapa and Zheng (2019), actualised affordances do not automatically translate into higher capabilities or functionalities (Thapa and Zheng, 2019). Along the similar veins, revelatory insights generated in this chapter into the role of affordances in forming organisational capabilities in the context of servitisation would be a substantial addition to the literature.

5.3 Introduction to Data Collection and Data Analysis

5.3.1 Data Collection

As mentioned in the methodology chapter, a multi-method approach have been used to collect data, starting around the beginning of 2021 and ending in the second half of 2022. The researcher followed the interview protocols (Kvale and Brinkmann, 2015) to ensure a systematic data collection approach (Patton, 2002). Semi-structured interviews, which consisted of formal and informal interviews, played a primary role in collecting the retrospective data and took place via online meetings (i.e., Tencent Meeting). For each case firm, the researcher was able to access participants with more than ten years of tenure in their sectors and have rich experience and expertise in digital platforms and their impact on business development. Moreover, the interviewed managers needed to work with co-workers across departments, thus having a good understanding of businesses and the use of platforms at the firm level. Following the recommendations of Myers and Newman (2007), all interviews were conducted in the interviewees' native language (Chinese) and were recorded and transcribed. In total, the researcher conducted 18 formal interviews and 11 informal interviews (e.g., through instant messengers and workshops). Further, the case firms interviewed herein were all listed companies, which have extensive coverage of their business online. This firm-specific data can provide a comprehensive view to the researcher, including different project level practices. The researcher obtained their annual reports, business reports and news from official websites and other public web pages, as well as WeChat enterprise accounts and other documents (e.g., secondary interviews) available online with their authenticity confirmed by interviewees, to enrich the dataset. This helps

to address potential retrospective bias and self-reporting issues in interview evidence (Gino and Pisano, 2008). Table 3.4 in Chapter Three summarises the data sources.

5.3.2 Data Analysis

As mentioned in the methodology chapter, a thematic analysis approach was applied to analyse data (Braun and Clarke, 2006) through following the three main steps as follows. The first step was a thorough analysis of the transcripts after the interviews were transcribed verbatim. Consequently, the researcher become familiar with the data, highlighting phrases and passages with reference to the RQs. During this process, the researcher coded the common words, phrases, terms, labels and phrases mentioned by interviewees, and tentatively generated initial codes that derived from the dataset.

The second step of the data analysis was to cluster, identify and review themes among the initial codes. Based on the objective to investigate how the notions of Heidegger may shed light on explaining and specifying perceptions of affordances and their actualisation, familiarity and referential whole were also chosen as themes in the data analysis to see whether the initial codes matched with the themes.

The third step involved reviewing the data extracts and codes for each theme a couple of times to compare the data, codes and themes, with the analytical focus being on capturing relevant links between the platform totality and the organisational actors' familiarity. The step formed the basis of linking these concepts to the perception of affordances and activities case firms performed to realise these affordances. The researcher also followed the abductive logic of reasoning (Bygstad *et al*., 2016) and moved back and forth among theory, literature and data to capture the explanation for the RQs in a best possible way.

5.4 Case Analysis

Our data indicate that incumbents' responses to digital servitisation require three stages of digital servitisation: (1) functional affordance driven digital transformation by imbuing a familiarity with platform referential whole, (2) digital servitisation through perceiving relational affordances and (3) capability development derived from ongoing, adaptive actions to enable superior servitisation outcomes. The three stages will be detailed in the following sections. The aforementioned stages supported with the interview quotes are depicted in Table 5.1.

Table 5.1: Three Stages of Digital Servitisation

Stage	Platform affordance	Key quotations from interviews/information from documents
Functional affordances for digital transformation	Process management affordance	The setup of a real big platform must come after the process optimisation . . . the platform is the outcome of transformation, which merges (optimised) organisational process and business model. Afterwards, it develops into a transaction platform or management platform. (General manager of Smart Engineering System -- Company 3)
		Our company spent nearly three to four years benefitting from the implemented digital platforms. During this process, we fixed bugs, and made changes, including the continuous process modification . . . we frequently updated, transformed, cancelled or added processes every two or three weeks. (R&D engineer -- Company 2)
	Data-driven operation affordance	Our production data and data on overseas sales can be combined in the big data platform, and consequently, we can know how many overseas orders are allocated to my factory, and how many products are being manufactured, and how many are out of inventory, and how many are being delivered, all these data can be calculated by the data platform. (Operation and production platform manager -- Company 1)
		Sales department needs us to assist them with the marketing activities, including pricing activities, sales prediction. For example, how many consumers would purchase our products this double 11, which can be calculated by the system. The prediction can get us prepared, for example, in terms of staffing and equipment. (Big data platform manager -- Company 1)
		What is more important is that the data can be better connected with the entire operations, in a way that all involved supply chain stakeholders, no matter sales or suppliers can see how the data relates to them, so the digital transformation of the entire supply chains would gain more involvement and support. (Chief transformation officer -- Company 5)
	Collaborative affordance	It is a platform for multiple people to work together. I think the purpose is to facilitate information transfer between links, processes and people, and simplify some complex work processes, improve work efficiency and open up information flows. (Chief operation officer -- Company 4)
		We have modules such as smart WIFI module and other apps to insert into our products, in that case, we would collaborate with Intelligence Research Institute for joint product development. (Product development manager -- Company 6)
		Quoting the words of our CIO, those who do not understand business is not a good IT technician. Our CIO has been to factories and involved in business. He directly stations in every business unit and brings his computer there. For example, he studied in [the] Finance department for a month. . . . Consequently, we are familiar with the business, and what we design fits their preferred way of doing business and their use habit. Something may

	seem irrational, but is a good fit with business units, such as the report we have recently designed. In that report, both first and last rows shows grand totals, which is more preferred by the business department. (Big data platform manager -- Company 1)
Product development affordance	Probably we still need to develop our products starting with samples in a traditional manner, but after R&D, we will make the outcomes available on the platform for customer utilisation or for sale. Meanwhile, we also have [a] more advanced way of R&D using some digitalised R&D systems or AI technologies, but the final outcomes are the same, the services will be offered through the platform. (General manager of engineering system -- Company 3)
	Our systems collect customer data, such as service maintenance records of all products, and sales data, including whether the exterior of our products is acceptable by the market. Based on the data, our R&D department would make improvements accordingly. (Product R&D manager -- Company 6)
	Our team provides software support to the physical products, for example, hardware and software can be combined, thus data about products are recorded on our platform, and we can control products through [the] software interface. (IoT manager -- Company 1)
	We can provide precise marketing through data collected on the platforms. For new customers, we would guide them to purchase our products, and for potential customers, we would give out coupons to convert them to our new customer . . . we also have independent transaction platforms where customers can view products there and buy their products . . . overseas warehousing systems can decide the shortest path and realise same-day or next-day delivery. (Big data platform manager -- Company 1)
Internal commitment and external support to push forward digital transformation while developing familiarity with platform whole	Company 4 may only have an eye on what has happened within their own enterprise. But we are different. When it comes to automobile industry, we have served different types of automobile manufacturers, like Dongfeng motor, BAIC, SAIC, Porsche, like Michelin, including both foreign-funded enterprises and domestic enterprises, the problems we have addressed before might also occur in Company 4. . . and the solutions we provided can be seen as the benchmark reference. (Marketing manager -- DataCVG)
	Involved key representatives in the project implementation, these representatives have collected the pain points and needs from their departments . . . what we can do is to help our clients with rounds of training, get them to see the product value and use it, and make them get used to utilising it. But the final outcome of whether they would rely on it mainly depends on the enterprise itself. (Marketing manager -- DataCVG)
	Despite this age, the chairman's thoughts in this respect (digitalisation) are still following the current development direction. Unlike others who regard [the] IT department or information system as a supplementary tool, from the investment the company made, their digital projects are fully supported by the management team. Coupled with organisational structure, whether they set up the research institute, or data department, the management set the tone in the organisation. This is beneficial to build organisational data culture or certain institutions, upon which the system implemented would not be likely to fall into disuse. (Marketing manager -- DataCVG)

		Successful transformation is not just to implement a set of system[s], but to cultivate a data culture, and use the data to support their operation. Cultivating such [a] data culture is not just [to] allow employees to add certain process through the system, more importantly, using the system is actually [to] cultivate firms' management habit, or data application habit in their work. (Marketing manager -- DataCVG) We have [an] ETTP online learning platform where experienced staff is required to upload their video to teach others how to use the system and figure out new ways of usage. . . . The learning platform actually reflects organisational culture and philosophy, and helps employees to develop a sense of belonging. (Big data platform manager -- Company 1) Courses would be designed and uploaded onto the Zhiniao Platform where general employees are required to complete and finish the examination. Besides, we have offline trainings around the theme of happiness . . . as we design the products, we are told the products are designed for our families and relatives. (Product manager -- Company 6) Regarding the previous supplier inspection, we went to the scene to inspect suppliers. During the bidding process, we must be on the scene. Due to the pandemic, our supplier inspection is carried out via video-conferencing platforms, including Zoom, Teams and Tencent Meeting, since this process involves multiple parties, such as entities related to procurement, technical responsibility party and users. Now all this would be done online. (Chief operating officer -- Company 4)
		When we open bid, we will use the system called e-bidding. It is a remote system for our bidding, which is developed by us. We start to use it this year. It may exist before, but was not used. (Chief operating officer -- Company 4)
		We are now still accumulating a growing number of customers, when the time is ripe, we can introduce more services on the platform to sell our products and services . . . we pay special attention to the platform architecture so that it accommodates any changes to emergent business scenarios. (IoT manager -- Company 1)
		Our advantage is that the products we developed can be applied to us. The application is not testing water but may have been used by us for a decade. We have been very familiar with the product usage in the whole set of scenarios. (RMC manager -- Company 5)
Relational affordances for digital servitisation	Transaction leverage affordance	We would add consumables that are used together with our products on the platform, so our consumers can buy them when they run out of these materials. (R&D engineer in Company 2)
	Resource orchestration affordance	We would first standardise design of the entire product, after that, we will decompose our products into elements. Then based on the algorithms developed through our considerable experience, modules can be combined intelligently based on customers' requirements. . . . The key thing is to decompose products into smallest elements, and then develop these elements into algorithms and modules, thus forming a[n] R&D system. (General manager of engineering system -- Company 3) We will decompose the entire supply chains into several service modules, and every service module can meet more emergent needs based on different target customers and markets. (Chief transformation officer -- Company 5)

		We have introduced [an] online open innovation platform. On that platform, we will demonstrate our internal technological needs to participating firms. Meanwhile, external firms whether they are large companies or start-ups can display their new technologies. Thus, the platform is operating like a multisided transaction platform in the field of technologies. (R&D engineer -- Company 2)
		Our company owns 35 factories around the world, including collaborative factories. We hope to use our resources in manufacturing network and quality management, including our global supplier system to empower domestic start-ups, especially those aiming to expand overseas market. (Chief transformation officer -- Company 5)
	Dynamic ambidexterity affordance	If you simply want to buy an ERP system, you can directly go to Kingdee. But if you want to buy a system that would affect your whole organisation, I feel we can provide the right product . . . we have engaged in all value chain activities, from manufacturing, production, sales, supply chain, quality management, and procurement, the company has extensive experiences. I am confident to say in [the] manufacturing industry, software provided by others is not as complete as the one from us. (R&D engineer -- Company 2)
Capability development for digital servitisation	Transaction leverage capability	We have a small platform which is used to interface with business partners. A part of data can flow to the partners, so do their data, which can also flow to us. On this platform, we can see the sales position in JD, and JD can also see the products that would be on sales on the date of 618 for example, which category accounts for most of the products, and are there any promotional advantages . . . this would facilitate our marketing activities. (R&D engineer -- Company 2)
		We open 80% of warehousing capacity to third parties. That is, goods from these customers can be deposited in our warehouses and we can help deliver the goods for them. There are massive data related to warehousing, logistics and customer usage and so forth. We also need to provide reports to our customers every month. Such massive data need to be handled through our data big platforms, combined with four to five different systems related to specific services . . . our warehousing system can actually be introduced to their own firms when they realise our system can support their business after they use our platforms. (Big data platform manager -- Company 1)
		We have thousands of suppliers, and the upstream suppliers are one of our resources. If all suppliers increase their efficiency after we use the systems, we can then introduce them to our suppliers, and third-party collaborators, it is convenient for us. Besides, the business scenarios of our suppliers and collaborators are similar. (RMC manager -- Company 5)
	Resource orchestration capability	Our consumers will use the app through our smart screen, and our IoT platform can collect their data and analyse the usage patterns, for example, if they do not listen to the music a lot every day, we would analyse whether the problem resides in the song resources or play stereo that we sourced. (IoT platform manager -- Company 1)
		We do not worry about the job hopping of our pattern masters when we cultivate them, because the relationship between our pattern masters and our company is not an employment relationship, but a partnership. They are shared and they work for us when customers make the request on the platform . . . besides, by directly connecting with the customers through internet and based on user needs data, our assembly line customisation

	platform can optimise all resources of expanding supply chains. (General manager of engineering system -- Company 3) So far we have more than 10 enterprises in our supply chains, and be part of the ecosystem. For example, we collaborated with a start-up, Ned Ltd and jointly developed [an] AR/VR product. . . . Recently, Ned has launched more intensive collaboration with [an] AR/VR business unit in our company, carrying out R&D in consumer products. (Head of global supply chain -- Company 5) Our platform can also open to our collaborators and provide them with SDKs. They can leverage our development experience, to enhance the intelligence of their products. For example, it would be taxing for them to develop a platform. But if they can integrate the services into our platform, it would be much easier, as we have developed a set of systems. . . . Their products can be integrated with our platform. Thus, we can control their products using voice technologies or our APP. (IoT platform manager -- Company 1) Such a service would be beneficial to us, because providing reliable financial products serves as a tool to monetise the travel and also increase customer stickiness, thus increasing their usage of our services. (CIO -- Company 4)
Dynamic ambidexterity capability	We have a smart stereo, users would use it for different purposes, such as asking for weather, listen to the music and others. The interactive information would flow to our big data platform for further analysis, such as [a] more accurate user persona. . . . This is a valuable source of data, upon which some commercial value can be discovered. For example, if customers like certain functions, we will make further improvements. . . . We can also sell our products and services based on [the] more accurate user persona. For example, we will insert the educational resources to the study desks, users can use it for free within a certain period, and then need to pay for it. (IoT platform manager -- Company 1) We need to change modules. First, languages are different. Second, laws and regulations in each country are different. Third, customer preferences are not the same. Modules need to be changed to accommodate these differences. (Big data platform manager -- Company 1) We have established this platform, and now we can provide more services. As more collaborators and customers use the platform, our platform can become bigger and more effective . . . the key point is the capability of your platform. When the capability is strong enough, you can do many things. (General manager of engineering system -- Company 3) AR/VR is expected to be [the] next-generation computing platform after [the] personal laptop and smart phones, it would bring a lot of new opportunities through its deep integration with core technologies such as big data and AI. (Head of global supply chain -- Company 5)

5.4.1 Functional Affordances in Digital Transformation

Our data show that incumbents initially pursue digital transformation by investing in implementing platforms, advanced technologies, practices and processes to extract benefits from digital technologies for their business value. To this end, enabled by layered modular architecture and the generative potential of digital technologies, four types of functional affordances are observed to come into play. They are process management affordance, data-driven operation affordance, collaborative affordance and product development affordance.

According to case evidence, the first salient functional affordance in firms is process management affordance. Process management affordance can be defined as an IT-facilitated possibility to 'design, prioritise, coordinate, implement, and monitor work processes that enable action and decision making that lead to desired process outcomes' (Chatterjee *et al*., 2015, p. 175). By converting analogue information to digital formats through embedding the digital platforms into the organisational fabric, firms can find themselves opportunities to optimise their practices and work processes. In other words, this is one of the reasons why digital platforms exist, which triggers and enables process adaptations and optimisation. Simultaneously, case firms update their platforms to meet emergent organisational needs, such as 'the platform is the outcome of transformation, which merges (optimised) organisational process and business model' mentioned by the general manager of smart engineering system in Company 3. Meanwhile, several respondents reported the necessity of continuous process improvement to benefit from platform use.

As processes become digitised and connected via the platform, voluminous data can be generated in operations and external databases can be leveraged to supplement incumbents' existing database. Consequently, digital platforms could bring data-driven operation affordance, which can be understood as an IT-facilitated possibility to allow organisations to pursue continual improvement in organisational activities through carrying out regular business practices supported with data. As firms increasingly digitalise their processes and practices, growing volumes of data can be generated. The data from multiple sources such as external digital platforms, enterprise platforms and IoT platforms can flow to the big data platform for analysis and provide actionable information to departments across the organisation to assist their decision-making and increase the operational performance. Both the operation and production platform manager and the big data platform manager from Company 1 mentioned the role of their big data platform in improving productivity by supporting other non-technical business units.

Based on the aforementioned two functional affordances, collaborative affordance becomes more prominent to organisational actors, especially across departments within the organisation. Collaborative affordance refers to an IT-facilitated possibility to allow organisational actors to work together, sharing, conveying and integrating each other's information and knowledge for coordination and collaboration, often with the use of IT-supported channels (Zammuto *et al*., 2007). The enactment of collaborative affordance is mainly due to information transparency arising from the integrated platforms across departments, which facilitates the completion of tasks. Equally important, collaborative affordance is observed between IT departments and business units to ensure digital platforms are implemented to fully support the business to benefit from digital

transformation. Consequently, the systems designed and implemented are more aligned with the needs and use scenarios. This is mentioned by the product manager in Company 6 in that 'IT staff would often station in business units, such as in our R&D building'.

Based on the aforementioned interactive effects of three functional affordances, incumbents could derive another important product development affordance. It refers to the whole IT-supported process from product concept development to the final delivery to end customers, including all value-added intermediate activities such as marketing and logistics. For consumer product firms, the goal of the digital transformation process is to serve consumers with value-added product offerings, with added-on services. In the case of Company 3, it combines the traditional approach with digital technologies for product development, and the output will be finally available on their platform. Simultaneously, the data collected on platforms provide feedback into the product development, which may be more relevant for R&D departments. Taking one step forward and to further enact product development affordance, case firms were observed to integrate IT-based approaches with their physical products to enable the starting point of providing smart products or services.

Process management, data-driven operation, collaboration and product development are seen as functional affordances, because they do not support 'a values-oriented analysis of IT artifacts' (Markus and Silver, 2008, p. 622). These affordances are discovered from the platform use due to their technological capabilities without further relying on focal firms' developed capabilities and constructed interpretation. Enacting these four functional affordances not only helps firms with digital transformation, but also develops a familiarity with platform referential totality. Their combination further presents

opportunities for firms to perceive more capability-driven, goal-oriented relational affordances in pursuit of a new strategic goal, that is, digital servitisation in this study.

Familiarity with referential totality to enable the enactment of functional affordances

Overall, two approaches would be adopted to enact functional affordances and develop a familiarity with platform totality. First of all, technology suppliers and third-party consultation firms can help firms with digitalisation and with platform design and implementation. Technological suppliers help firms with familiarity with the totality of the platforms. The technology supplier DataCVG to Company 3 and Company 4 is a good illustration. Building on the experience and know-how from serving other industries, DataCVG transferred knowledge, frameworks and methodology to the digital platform implementations to Company 3 and Company 4, which can help them access more feasible solutions than if they implemented it by themselves. In Company 4, the digital platforms developed by itself did not turn out to be a success, and it restarted the project with the support of DataCVG. In other words, based on the company's ideas, DataCVG developed a product, and through stepwise iteration, the system was finally applied by the firm. In this regard, the marketing manager of DataCVG pointed out its advantages in serving diverse customers across different types of automobile manufacturers, and the solutions it provided would be more representative. To create a more customised solution, DataCVG consistently and actively involved users throughout the platform's design and development. More importantly, as pointed out in the prior literature (e.g., Björkdahl, 2020; Volberda *et al*., 2021) and also highlighted by the marketing manager in DataCVG, the role of top management teams and organisational readiness such as organisational culture and structure can provide a sustained boost to push digital transformation forward.

Second, internal efforts within the organisational boundary should also be put into place. In addition to the close collaborative ties built between IT departments and business units for IT-business alignment, firms establish a digital department to aid digital transformation at the organisation-wide level. The digital department is granted authorisation from the management team to liaise with different departments, creating an imperative that all departments need to use digital platforms for their tasks and business. For instance, in Company 2, part of its job responsibility is to ensure systematic operation of the process through collecting organisation-wide feedback biannually.

In the meantime, companies deliver constant training to help organisational actors develop their sensemaking and skills towards the usage of digital platforms. Nearly all case firms have set up internal online learning platforms where employees are required to complete courses and assessment, thus recognising the perceived and potential values of digital platforms. Besides, the big data platform manager in Company 1 and the product manager in Company 6 associated the training with a sense of belonging to the organisation, hence increasing their platform use and enhancing platform referential totality. This observation echoes the work of Bouncken and Barwinski (2020) who proposed the shared digital identity featuring a sense of community, and common values and norms. Moreover, the familiarity of systems derived from increased usage would expand in the context of the COVID-19 pandemic because certain systems must be used to facilitate remote interfirm collaboration. This can be illustrated by converting offline supplier inspection to online in bidding in Company 4 via video-conferencing platforms.

Looking at the properties of digital platforms and embedded systems, and then actualising identified functional affordances to support digital transformation, creates

conditions where organisations treat these information systems as 'ready-to-hand' mode rather than previous 'present-at-hand' mode (Lanamäki *et al*., 2015, p. 6). Besides, as observed, some functional affordances overlap with each other while being enacted. For example, data-driven operation affordance could lead to optimised process design. Customer data, such as complaints and reviews, have been considered as strategic assets to consumer product manufacturers. When complaints revolve mainly around quality issues, such data can be fed directly back to the production end, thereby facilitating improvements in product development and quality control. On certain occasions, firms may even optimise their management by redesigning their business processes

Because of the co-alignment of functional affordances (Chatterjee *et al*., 2020), enacting the affordances could lead to a positive cycle of actualisation, further enhancing the familiarity of digital artefacts and their functions. This familiarity, as mentioned earlier, is a precognitive and background understanding, involvement and engagement with platforms in the context of digital transformation. The familiarity also manifests itself through greater usage of platforms for specific tasks that departments could perform with the platforms and the subsequent identity (technology-driven companies) firms assume. After organisational actors gained this familiarity and developed sufficient skills, they aimed to generate more value through pushing forwards digitally enabled servitisation. As expressed by the respondents from Company 1 and Company 5, digital servitisation is naturally followed by the digital transformation to exploit the value of digital assets and repurposing their existing non-digital materials. For instance, in the digital transformation, product development affordance enables digitalising the original physical offerings through inserting advanced sensors, and other technological components. Overseas

warehousing services can open to other business customers. All the aforementioned efforts underpin the development of the expanding familiarity of the platforms referential whole, making the subsequent servitised model more easily attainable.

Realising digital servitisation through the perception of relational affordances

The acquisition of familiarity with the platform whole influences the perception of three relational affordances to enable service business – transaction leverage, resource orchestration and dynamic ambidexterity. As the platform users and also designers, firms can modify and evolve their platforms based on their capabilities and intents over time to further facilitate the journey of servitisation. These three affordances help incumbents with value creation and capture to varying degrees, which is contingent upon the practices they enact (Fayard and Weeks, 2014).

Transaction leverage affordance

Transaction leverage affordance can be known as an IT-facilitated possibility to transact with a growing base of customers, allowing for purchasing products/services from the firm's product ecosystem, thereby reducing their search costs. Based on the observation, nearly all case firms have made early attempts to adopt external digital platforms such as social media platforms and online transaction platforms such as Taobao, JD and Tiktok. Such types of digital platforms are purported to help firms with value creation because of ease of adoption and ease of connection with customers and suppliers, as well as the affordability (Yoo *et al*., 2010, 2012).

Besides, nearly all case firms have launched their apps to provide enriched use experience of their product offerings. In addition to customer-related services such as after-sales support, and additional services that complement product usage, firms have also

included the transaction function in apps, allowing customers to place an order as they browse the app.

Resource orchestration affordance

Resource orchestration affordance can be known as an IT-facilitated possibility to obtain, reconfigure, and integrate internal and external resources. In the context of the platform, the increasing level of layered modularity can be leveraged to modularise products and services and enrich these modules based on accumulated digital assets, realising resource orchestration.

To garner value from the capabilities and resources that Company 5 developed, the chief transformation officer shared their experience of repurposing their capabilities by converting them into services, such as decomposing the entire supply chains into several service modules, and every service module can meet more emergent needs based on different target customers and markets. Meanwhile, digital servitisation often necessitates wider and deeper collaborative ties of business partners (Fu *et al*., 2022). In this respect, platforms serve as a viable channel for firms to orchestrate internal and external resources. A good example is the setup of an online open innovation platform in Company 2, which operates like a multisided transaction platform in the field of technologies and technological innovation. The chief transformation officer of Company 5 expressed the similar viewpoint of including start-ups that tend to lack resources but may display complementary capabilities and resources, thus jointly developing more entrepreneurial opportunities.

Dynamic ambidexterity affordance

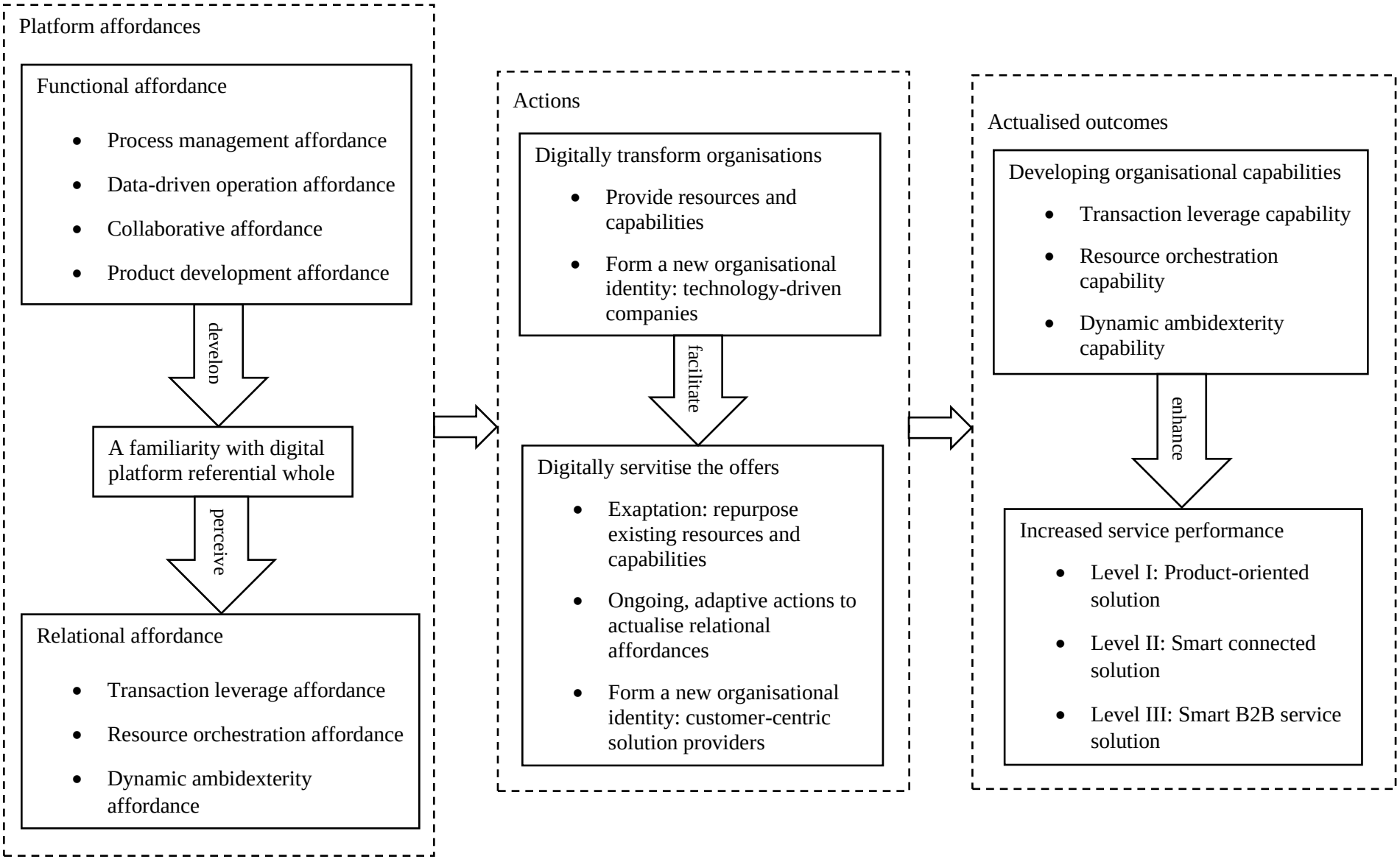
Dynamic ambidexterity affordance represents the potential for firms to engage in experimentation and launch both exploratory and exploitative initiatives, targeting new market segments and serving existing customers. Such action possibilities can be enabled due to the layered modular architecture of platforms (Sun *et al*., 2021). According to the interviewees, all case firms have established business divisions to explore the potential of digital platforms by recognising new business opportunities to expand the scope of service business. Although platforms have been observed to facilitate the development of exploitative business, such as value-adding services to existing customers based on their product usage behaviours, platforms can be redesigned or developed to explore and realise new business opportunities. In the case of Company 4, the company redefines the user demand, and explores the 'big travel' market through building a new platform business ecosystem. In the case of Company 2, the company can not only develop and provide software to business customers but also utilise the data stored in the platform to implement green strategies. Company 1 is attempting to open its overseas warehousing to other firms to maximise the use of their assets and can also sell its self-developed warehousing systems to these clients.

Forming organisational capabilities through enacting relational affordances

Compared to perceiving relational affordances for servitisation, firms could find themselves in difficulty with affordance actualisation. This is because in the real world, benefitting from higher-level relational affordances often entails the coordinated actions across several related departments. Using one of the case firms as an example, to realise dynamic ambidexterity affordance – that is, to launch service businesses on the app

embedded within the smart screen on the physical products – business departments and product departments should collect the corresponding feedback about product features and sense the business opportunity, such as providing educational resources on its app in Company 1; the business department then evaluates the choices of education-related resources, and the IT department designs the appropriate module accordingly and puts it into service. The collective efforts would be more complex in the real world, which is reflected by the notion of co-alignment of affordances (Chatterjee *et al*., 2020). Besides, the case firms appropriated the same affordances in multiple ways through repurposing of their existing digital assets, non-digital resources, capabilities and skills, a process known as exaptation (Dew and Sarasvathy, 2016). As a result, the same affordances can lead to novel uses and create differential value. Such repurposing activities explain how and why some case firms would engage in more ongoing, adaptive actions to benefit from affordances. These actions form the micro foundation of corresponding IT-enabled organisational capabilities (Nayak *et al*., 2020). Figure 5.2 visualises the theoretical framework of platform-enabled servisatisation. From the dataset, three new organisational capabilities emerge from continuous actualisations of corresponding affordances.

Figure 5.2: Theoretical Framework of Platform-Enabled Servisatisation



Transaction leverage capability

Transaction leverage capability refers to the ability to attract and transact with a growing number of customers based on product offerings, which is important for value capture for firms. All case firms were observed to partner with transaction platforms such as JD.com and Taobao to assist marketing activities to access a large base of individual customers. Because transaction platforms provide data services to their clients, case firms use data and their analytics for further value creation, such as providing useful guidelines for new product development. Moreover, some manufacturers have been observed to go one step further to build strategic partnerships with them, like Company 2. The company established a supplementary platform to interface with the JD e-commerce platform, which facilitates promoting marketing activities and developing strategies to cater to different market segments with different types of products.

Besides, the interviewed firms have all developed apps to enrich the product usage experience. During this process, companies create transaction opportunities. Over time, Company 1 also found opportunities to open its independent transaction platform to other noncompeting firms, starting with its suppliers, to expand the revenue streams and also increase product categories on the platform. Nearly all case firms have chosen to include their collaborators' products into their apps to reduce the transaction cost and search cost to develop a product ecosystem. This is because as firms enrich the usage scenarios of products and service businesses, more product suppliers and service providers are involved to interact with customers, converting the transaction platform with limited firm products into a two-sided transaction platform. In some instances, the prices of the complementary products such as materials needed for product usage could be lower than those in the market.

Based on existing resources, Company 1 opens its overseas warehouses, and Company 4 embarks on travel business supported by its automobiles to develop service business. These two case firms launch new services through reshaping the use of their existing resources with the support of the platform approach, benefiting them from resource orchestration affordance. In the case of Company 4, it leverages its automobile operation capability, self-provided vehicles, and hires drivers who would receive unified training to provide travel services to users. In addition to consumers, the service is targeted at business customers who have needs of using cars because business customers can bring more stable revenues once relationships are fostered. Besides, to realise the transaction leverage affordance, its app can interface with other platforms such as the intelligent working platform, Ding Talk, to leverage external resources and reduce transaction costs of business customers.

At the early stage of B2B service provision, because the new service introduced to the market is distinctive from case firms' product offerings, to create reputation and seek legitimacy in the new area, collaborating with governments to engage in public projects was seen to be effective to build legitimacy and reputation. Besides, in the case of Company 1, the company opens its self-built e-commerce platform to a growing number of business customers and service providers to enhance its brand and realise their strategic goal of becoming 'JD' in overseas markets. Such a strategic move is also conducive to customers because they can be offered more products. Besides, since case firms could have a number of supply chain actors for the products, including an increasing number of collaborators such as service providers, these collaborating companies could have first-hand experience of the value of the digital solutions and are considered potential users.

Resource orchestration capability

Resource orchestration capability refers to the ability to carry out resource-focused actions to manage a dynamic resource portfolio and help firms to realise their goal. Digital assets are the primary source of resource orchestration to enable service offerings. First, different types of apps were developed and introduced, which can be built upon technology platforms. There are mainly two types of apps, one of which is the marketing platform provided by Company 6. It integrates the features and functions of the social media and the transaction functions. The other is the functional platform, which is preconditioned on the fact the manufacturers have already inserted IoT sensors into their products. This functional platform can provide smart services to customers and also develop modules to cover various functions of the marketing platform.

Platforms also enable resource orchestration primarily by accessing customer data, which then informs manufacturers about the appropriate resources they should acquire. In Company 1, the IoT platform can integrate with external databases related to music or cuisine to cater to different customer preferences. This can in turn inform the company of the suppliers to collaborate with. To enact resource orchestration affordance, in addition to the common practice of sharing data such as production plan and inventory with their suppliers, case firms engage in different practices to enact resource orchestration affordance. For example, Company 1 and Company 2 connect with a growing number of business partners in the form of acquisition, strategic investment, and joint product development to enhance value (co)creation to enact resource orchestration affordance. Another practice adopted by Company 3 to leverage external resources is to reshape relationships of network members.

Further, firms have taken actions to leverage external resources and support their supply chain partners through externalising their own resources and capabilities (Eloranta and Turunen, 2016), crucial for joint product/service development. In this regard, both the head of global supply chain and the chief transformation officer in Company 5 highlighted the importance of supporting collaborators in their expanding supply chains. Specifically, facilitated by increasingly innovation-oriented supply chain platforms serving enterprise customers, Company 5 can harness the self-used supply chain, branding, sales channels and service systems to empower the collaborators to expand their business and establish brand. In addition to opening up the transaction platform, cases like Company 1 and Company 5 open up innovation platforms such as the IoT platform to more collaborators to expand their product ecosystem, a strategic move for firms to enrich usage scenarios.

Meanwhile, companies can also repurpose their platforms through enabling additional sources of platform leverage (Thomas *et al*., 2014) by adding modules developed by the collaborators to provide a more comprehensive solution. Respondents in Company 1 and Company 4 reported on app interfacing to enrich customer experience. IoT manager in Company 1 reported on their future plan to collaborate with other smart home device manufacturers to enable integration with their platform through app interfacing. Company 4 provides financial services to customers through strategic collaboration such as ZHAOLIAN Finance on its transaction travel app. The collaborator provided the module, and the company integrated it with the application platform through a standard interface.

Dynamic ambidexterity capability

Dynamic ambidexterity capability refers to the organisational capability to discover, recognise and realise the business opportunities to launch explorative and/or exploitative

initiatives within a portfolio. The integration of physical products with software and their connection with functional platforms provide a starting point for service development on products. Specifically, based on a better understanding of customer preferences through big data analytics or market research conducted by IT and business departments, manufacturers can provide advanced and customised services to customers.

The platform business model can be easily copied and applied to expand firms' service business in new markets. For instance, Company 1 has considered expanding overseas warehousing to the other continents, such as Asia, to serve more business customers. Similarly, by replicating the capabilities of its industrial internet, Company 3 has launched a new business in women's and children's wear and would include all categories in the apparel industry based on market needs. In addition, the emergence of a business ecosystem sets the stage for firms to enter new business areas. The strategic partnerships could function as a feasible approach to introduce business opportunities, providing increased utility to individual customers. In the instance of Company 5, with the investment in Ned, more business initiatives could be made possible by integrating AR/VR with its existing technologies.

The data indicate that incumbents start the B2B service business through repurposing their resources and capabilities that were initially applied to themselves. For instance, examples such as Company 5 decomposes its supply chains, Company 3 decomposes its Manufacturers-to-Consumer manufacturing capacities to cater to different needs of business customers and Company 2 decomposes its digital systems, and recombines the modules to cater to the different needs of business customers. Consequently,

these firms develop corresponding software and digital solutions to their clients based on their accumulated domain knowledge, advanced algorithms and service modules.

To summarise, Table 5.2 provides an overview of ongoing, adaptive actions that each case firm has performed. These relatively representative practices facilitate the development of distinctive capabilities and three levels of digital servitisation when their platforms transition towards more open platforms, attracting an increasing number of participants for value creation.

Table 5.2: Analysis of Case Firms' Ongoing, Adaptive Actions for Servitisation

Capabilities / Actions / Level of digital servitization	**Transaction leverage capability**	**Resource orchestration capability**	**Dynamic ambidexterity capability**
Level I: a bundle of products and services mainly developed by the manufacturers to increase the consumer utility or outcomes	Partner with third-party transaction platforms (e.g., JD.com, Taobao.com) (all companies); Develop a self-built transaction platform (all companies); Add transaction module in the apps (all companies)	Digital data such as customer data, can inform manufacturers of the resources to have, and the business partners manufacturers to collaborate (all companies); develop apps on innovation platforms (all companies); Make effective use of organisational resources based on real-time information collection and analysis on the platform (all companies)	Introduce free of charge services or pay-per-use services based on the tangible products (all companies)
Level I outcome	Increased transaction opportunities through internal and external transaction platforms	Effective integration, creation and use of organisational resources	Exploitative business to meet emergent needs of existing customers
Level II: connecting with an expanding base of business partners, including actors in its value chains to provide a complete solution to their existing and new customers in B2C market.	Open the self-built e-commerce platform to collaborators (Company 1); Include products from collaborators in the Apps to reduce search cost and transaction cost (all companies)	Open the platform to collaborators (Company 1, 2); Share data with supply chain partners (all companies); Collaborate with a growing number of business partners in different forms (e.g., loose coupled integrated, acquisition, strategic investment or joint product development) (Company 1, 2, 3, 4, 5);	Provide complementary services or products on the platform to cater to more customers to exploit exising resources and capabilities (all companies); Seek for new business opportunities through partnerships (all companies)

		Externalise firms' resources and capabilities to support the selective partners and form an emergent business ecosystem (all companies)	
Level II outcome	A two-sided platform opening to collaborators	An emergent business ecosystem organised around the product offerings	Exploitative and exploratory services to serve existing and new customers by leveraging existing resources and capabilities
Level III: developing and providing products and customized services based on companies' existing resources and capabilities to serve business customers through explorative and exploitative innovations	Collaborate with the (local) government or government units to build legitimacy and reputation (Company 1, 2, 4, 5, 6); Introduce the digital products to collaborators (Company 5); Open its self-built e-commerce platform to other to further enhance its brand to increase transactions in the new service area (Company 1)	Develop new platforms to capture new business opportunities (all companies); Interface modules provided by collaborators to serve shared customers (all companies); Decompose resources and capabilities into modules (Company 2, 3, 5); Open resources and capabilities to potential business customers (Company 1, 5); Collaborate to leverage third-party platform resources through app interfacing (Company 1, 4)	Convert resources and capabilities into new services by repurposing the business units or set up new business unit or subsidiary (all companies)
Level III outcome	A multi-sided platform with a growing number of service providers involved to increase transaction	Reshaping the use of existing resources and capabilities to develop an emergent platform ecosystem	Exploratory services to serve new business customers by leveraging existing resources and capabilities

CHAPTER 6 DISCUSSION

Digital platforms, in particular innovation platforms, can be leveraged by firms in service and manufacturing industries to innovate their value creation through architectural leverage (Thomas *et al.*, 2014). However, how firms harness the logic of innovation leverage or a multi-logic architectural leverage in different business contexts and reap the full benefits of platforms deserve more research attention. This thesis attempts to present fine-grained information of value creation dynamics for both service providers and manufacturers on platforms and provides a rationale behind firms' varied business practices.

Based on research questions, identifying platform affordances constitutes the first building block of platform-enabled value creation. Platform affordances on value creation are affected by both platforms (e.g., platform development stages) and platform firms (e.g., level of digital transformation, organisational capabilities). Study 1 is focused on platform development and value creation dynamics as platforms develop, and Study 2 examines capability development facilitated by the continuous affordance actualisation in the journey of servitisation. Therefore, the succeeding section is dedicated to the focal point of each study. Before providing a detailed discussion, Table 6.1 presents an overview of the findings from the two preceding chapters.

Table 6.1: Summary of Two Findings in Chapter Four and Chapter Five

Affordances and their impact on value creation	Knowledge-intensive service providers	Servitised consumer product manufacturers	Discussion
Platform affordances	Organisational memory affordance Product/service development affordance Collaborative affordance Opportunity discovery affordance	Functional affordances: process management affordance; data-driven operation affordance; collaborative affordance; product development affordance Relational affordances: transaction leverage; resource orchestration; dynamic ambidexterity	Due to different research contexts in service and manufacturing industries, different types of affordances can be identified. Though collaborative affordance is identified in both studies, they differ as the former is focused on interfirm collaborative ties, while the latter is mainly about intrafirm collaboration to facilitate organisation-wide digital transformation. Servitised consumer manufacturers see complexity and challenges, such as inertia and recognition of new identity. Leveraging first-order functional affordances can be a starting point of digitally transforming themselves.
Impacts of affordances on value creation	In the introduction stage, platform firms exploit basic affordances by arriving at the fit between core knowledge management teams have and other sources of data and knowledge to make their technology core more competitive, and thus meet the basic needs of their customers on hand; In the growth stage, platform firms actively engage in open collaborative innovation with business customers and partners to prioritise growth and business expansion through developing more customised solutions across industries; In the maturity stage,	Enacting relational affordances with different value creation practices led to the three levels of digital servitisation: product-oriented solution, smart connected solution and smart B2B service solution. Transaction leverage affordance enables firms to promote efficient transaction opportunities; resource orchestration affordance enables firms to access, integrate, create and apply both internal and external resources, which is critical to service innovation; dynamic ambidexterity affordance enables firms to recognise and capture emergent needs	Service firms can increase their levels of strength (Evans *et al*., 2016), evolving from basic to synergistic affordances to create ongoing value as the platforms transition from being nascent to mature. Service providers that build their business model on platforms should engage in appropriate level of open innovation to grow their business based on their in-house platform development. This observation complements the platform openness and governance literature that is more focused on paradox issues (Tiwana, 2015; Thomas *et al*., 2014). Servitised consumer product firms need to ensure that three levels of digital servitisation co-exist and develop with each other. Developing the awareness

	platform firms leverage its emergent open innovation ecosystem, and enables to leverage the synergistic effects of the enhanced affordances, termed as synergistic affordances to provide continual service innovations in the ecosystem.	from existing and potentially new customers through explorative and exploitative service innovation. The three affordances were actualised through different ongoing and adaptive actions to serve the specific business goal for each level.	and capability to actualise the identified affordances in diverse ways is crucial for enhancing service performance and expanding the scope.
Platform development	According to the role of affordances in each stage, platform development stages can be respectively labelled as exploitative affordances, affordance ambidexterity and connected affordance synergies. Though the specific goal in each stage has been identified in the platform literature, Study 1 unearths the driving forces, which function as the signal for transition. Specifically, IT-business misalignments indicate that firms need to engage in appropriate open innovation practices to capture profit-seeking business opportunities in the emergent open innovation ecosystems.	Consumer product firms observed the necessity of developing their internal platform to digital platforms (e.g., IoT platforms, big data platforms) that enable them to provide a complete solution. As the level of digital servitisation increase along with organisational resource and capability development, focal firms add multiple platform leverage logics and increase platform openness for other complementors to build their contributions. Some of the practices include open the platform to noncompeting partners, to existing and new non-traditional supply chain actors.	Due to limited resources and limited domain knowledge of their serving industries, digital-born service providers often find it imperative to develop their platform, collaborate with partners, and increase its competitiveness to pursue a dominant position and engage in profit-seeking business activities in the ecosystems. Therefore, they need to identify the driving forces and evolve their affordances for enhanced value creation. Manufacturing firms develop their platforms based on factors such as organisational readiness, strategic goal (e.g., digital transformation and/or digital servitisation, what types of service to provide).
Digital transformation	Level of their business customers' digital transformation affects platform firms' value creation activities. It is found that the attitude and readiness of corporate clients to adopt digital products, still nascent to customers, can be a stumbling block for digital ventures. In addition, customers' lacking appropriate product usage capabilities, which are believed to negatively affect value creation and capture of both sides.	The finding is also reported in consumer product firms from the perspective of technology users. digital transformation – the prequel stage of digital servitisation – features the exploration and exploitation of four functional affordances. Actualising functional affordances leads to the development of a digital platform totality within firms, and new identity as technology-driven companies. Moreover, digital transformation provides firms with the necessary resources and capabilities,	Given that case firms in Study 1 are technology service providers that provide solutions to help customers digitally transform their business or organisation activities, the role of digital transformation can thus be explored both from the digital providers and customers' perspectives. For service providers, not only should they identify potential value creation issues due to the development stage their customers are currently in, but they need to take appropriate solutions, such as determining the types of (basic or advanced) offerings, considering organisational (re)design. Manufacturing firms could work independently or

		with which they can be repurposed to develop service business.	collaboratively with technology suppliers to make their functional affordances, often manifested with functions, more salient and accessible to increase the level of user involvement in organisational activities.
Capability development	Digital-born service providers are observed to reach a fit between their technological capability of platforms and their business expansion goals – IT-business misalignment – to further develop their platforms and business.	Three types of relational affordances can be actualised by ongoing and adaptative actions, which accords with the exaptation mechanism in a familiarity of digital platform totality. As such, there emerges three types of capabilities: transaction leverage capability, resource orchestration capability, and dynamic ambidexterity capability.	Technological capabilities of platforms provides foundations upon which platform affordances can be identified by the platform firms and increase the level of strength to enhance value creation at each stage of platform development. This is at the core of Study 1. Consumer product firms need to develop a new set of capabilities along with newly developed servitised business. The capability development mechanism provides an alternative perspective of how new organisational capabilities can be developed as platforms are used beyond their functions, which is one of the contributions of Study 2.

6.1 Platform Affordances

Before embarking on discussing the value of platform affordances, it is necessary to determine distinct types of affordances based on the organisational goals and specific use contexts (Volkoff and Strong, 2017). For knowledge-intensive digital ventures, four affordances are identified, that is, organisational memory affordance, product/service development affordance, collaborative affordance and opportunity discovery affordance. Despite the importance of complementors and addressing the paradox of including more complementors while ensuring the stability, the four types of affordances identified herein suggest the possible ways of value creation with the involvement of all stakeholders as the platforms emerge and develop. However, in manufacturing incumbents such as consumer product firms, the researcher identifies two sets of affordances, functional affordances and relational affordances. Existing literature has distinguished the differences between functional affordances and relational affordances and suggested that the actualisation of functional affordances could result in the perception of relational affordances. However, confusion still exists as regards their relationship. This study instead holds the view that as organisations actualise functional affordances, they not only create a familiarity of platform whole, but also acquire resources and capabilities that can be applied to other purposes. The aforementioned provides a fruitful breeding ground for the perception and actualisation of relational affordances in more effective ways over time as organisations forge new strategic goals. In Chapter Five, as firms implement digital platforms to pursue digital transformation, the initially perceived functional affordances include process management affordance, data-driven operation affordance, collaborative affordance and product development affordance, whereas relational affordances that are leveraged for

digital servitisation are transaction leverage affordance, resource orchestration affordance, and dynamic ambidexterity affordance. Both research findings indicate that the emergence and enactment of affordances should not be considered independently.

Prior studies have discussed the role organisational memory affordance and collaborative affordance in organisational innovation to varying degree (Chatterjee *et al*., 2015, 2020). Chapter Four provides a unique dataset and explores the impact of these two affordances alongside two new affordances in value creation activities of knowledge-intensive firms in service industries. First, organisational memory affordance is especially relevant to digital-born ventures because they can incorporate the value derived massive digital data into market offerings through disruptive technologies. Platforms can integrate with external databases and combine with advanced technologies such as machine learning and big data analytics, while firms can translate digital data into knowledge (Barney *et al*., 2001), which further feeds into customer offerings. For example, as reported in Company A, by developing collaborative ties with material suppliers, based on the reverse prediction of the chemical synthesis pathway, the pricing of each material on the pathway and the cost of different solutions can be calculated on its platform. Actually, the company has started to collaborate with material suppliers who could offer discount for those who buy its product through the platform.

In addition to collaborative affordance as noted in the preceding discussion, which may be easily actualised on the platforms to exploit network effects to serve more customers. For knowledge-intensive companies serving business customers, their clients care more about whether their solution providers have served some others in their areas because of their heterogenous needs and unique business scenarios as the respondent in

Company B stressed. Therefore, these case firms would strive to collaborate with leading firms in each industry, hoping to access their real business scenarios, understand their pain points and gain legitimacy and reputation. Focal firms can further ameliorate platform functionalities based on the data collected about customers' preferences and product usage.

Though Zammuto *et al*. (2007) conceptually mentioned the affordance of real-time/flexible product and service creation as 'the ability to create software-enhanced products and services by quickly recombing components in new and innovative ways' (p. 754), Chapter Four provides empirical evidence as regards the value creation mechanisms of product and service development along with the business goals in each phase. As observed, technological innovation, such as the introduction of SaaS-based products; collaborative ties with business partners to develop new applications and exploit existing databases for new values with other institutions; and discovering latent customer needs could all contribute to developing innovative products and services. As such, platform firms could adapt their customer offerings as they perceive new business opportunities.

The final opportunity discovery affordance is particularly pertinent to platform firms in their early stages of platform development because they devote their efforts to creating a viable business model that can be repeatable and scalable. In the case of Company C, its platform started by developing websites for clients, which, according to the interviewee, created limited value for clients and may not support platform development. After perceiving greater value creation potential from offering marketing services, it quickly changed the market offerings with the emergence of a SaaS-based marketing platform. Further, due to accumulated experience and knowledge, these platform firms could be more knowledgeable than their clients, as interviewees from Company B,

C and D mentioned. They can not only identify clients' latent business needs, but also launch consulting services to expand business opportunities and the revenue stream. More importantly, platforms serve as a feasible venue for experimentation and connect external sources through the developed boundary resources. As Marston *et al* (2011) suggested, novel digital technologies such as cloud computing could reduce the costs of such experimentation.

For more traditional consumer product manufacturers, product development affordance such as smart, connected products with cyber-physical arrangements along with added-on services may constitute the first attempt to provide service offerings. On the one hand, smart products could create value by themselves or as part of larger ensembles, establishing new forms of customer interaction (Raff *et al*., 2020). On the other hand, repurposing the existing services is another viable way of offering service business. However, compared to the digital-born ventures studied in Chapter Four, incumbents' success may entail greater managerial efforts to deal with types of organisational inertia (Mikalef *et al*., 2021). Though the value of digital technologies to servitisation is well recognised (Frank *et al*., 2019), most studies are silent about the convergence between servitisation and digital transformation, which can be seen as an antecedent of servitisation. Based on the interviews, Chapter Five illustrates that digital transformation is critically important for consumer product firms for the planning and exploration of the subsequent servitisation. As explained, facilitated by external support and internal commitment, digital transformation – the prequel stage of digital servitisation – features the exploration and exploitation of four functional affordances, that is, process management affordance, data-driven operation affordance, collaborative affordance and product development affordance.

The first three functional affordances are also complementary and combine to increase the ease with which product development affordance is undertaken.

In terms of process management affordance, nearly all case firms stressed that platforms enable process modification and optimisation through reducing work redundancies, improving efficiency and effectiveness when navigating digital transformation. Data-driven operation affordance is made possible due to the platform–facilitated opportunities to integrate heterogeneous sources of data, information, and knowledge, whether from the sides of customers and supply chain partners, or their own side such as operations and productions after data are digitised. Based on the aforementioned two functional affordances, collaborative affordance becomes more salient across departments, such as IT or digital department, business department and product R&D department. Though collaborative affordance is identified by both types of firms, knowledge-intensive ventures strive to foster interfirm collaborative ties to grow business and secure domain knowledge to enable customer offerings. In manufacturing incumbents, attention is predominantly paid to intrafirm collaborative affordance, and this affordance is crucial for countering organisational inertia (Mikalef *et al*., 2021), which is often cited as a barrier to digital transformation. In fact, such collaboration is imperative to interpret the IT/IS strategy as a 'shared-view of the IS role within the organisation' (Chen *et al*., 2010, p. 241), which could lay a solid foundation for product development as the digital technologies become part of the product, including other value-added services such as logistics services.

The evidence shows that as opposed to mainly digital products in platform-native service providers, the smart products are the starting point of initiating service offerings as

manufacturers try to distinguish themselves from their competitors with value-added services. Going one step further, after manufacturing companies recognise the need to repurpose their resources and capabilities to increase the revenues or expand business opportunities, they embark on digital servitisation. The organisations in all cases identify three relational affordances, which are more driven by organisations' capabilities and value. Given that case firms are both platform designers and users, their dual roles are important to enact the affordances after they are perceived. Specifically, transaction leverage affordance, resource orchestration affordance and dynamic ambidexterity affordance are found to be pertinent for value creation and value capture in the context of servitisation. Firms tap into transaction leverage affordance through the notion of architectural leverage (Thomas *et al*., 2014). First, in addition to collaborating with third-party transaction platforms such as JD.com and Taobao.com, they could develop their own transaction platform such as in the case of Company 1. Besides, they include a new platform-leverage logic in their IoT platform, transforming it from an innovation-leverage platform to both an innovation-leverage and transaction leverage platform. Furthermore, they can open the platform to allow others (e.g., business partners or business customers) to participate to reduce search costs and improve transaction efficiency, and at the same time, to build and explore the network effect.

Resource orchestration affordance includes not only modules developed on platforms, but also resources and capabilities residing in and outside the firm boundaries. Because platforms can connect manifold groups of users, they are increasingly recognised as a venue for value co-creation (e.g., Ramaswamy and Ozcan, 2018; Schreieck *et al*., 2021; Tian *et al*., 2021b; Ceccagnoli *et al*., 2012). Meanwhile, the platform development per se

could be the result of open innovation (George *et al*., 2014), which demands the sharing of resources and capabilities of involved actors. Besides, Chapter Five reveals that through setting up sub-platforms and the integration of systems on platforms, such as a smart scheduling system combined with different databases in the case of Company 3, digital and nondigital assets could be developed and used more effectively in focal firms to meet customer needs. Consequently, firms can offer services from non-digital to digital, depending on the degree of digitalisation. Resource orchestration affordance together with dynamic ambidexterity affordance is important for firms to ensure continuous value creation.

Similar to opportunity discovery affordance identified in Chapter Four, dynamic ambidexterity affordance refers to the discovery and fulfilment of both explorative and exploratory business opportunities to innovate market offerings. For knowledge-intensive firms, the enactment of opportunity discovery affordance is largely reflected by added functions to serve the existing clients. Their intention to enter new markets or industries is primarily driven by these firms' intent to grow the business and platform through exploring and exploiting existing digital assets. Such efforts can be facilitated by the modular layered architecture of the platform and the generative potential after collaborating with diverse customers and business partners across industries.

For consumer product firms, they can enrich their service offering through smart products and even go further to provide the aforementioned digital service, either provided by themselves or complementary providers. Like knowledge-intensive companies, consumer goods companies' attempts to serve new customers can be driven by the perception of new business opportunities through exploring and exploiting existing digital

resources, or repurposing nondigital resources such as the renting of overseas warehouses to other non-competing firms doing business overseas as in the case of Company 1. Meanwhile, as observed, their new ways of tapping into new markets or industries are driven by promising business opportunities, forming complementary connections to their product offerings in certain ways. A good illustration is Company 2's trials in industrial robots used for manufacturing, or perceiving the new business opportunities such as big travel, which can be realised through the setup of a new platform along with their possessed resources as in the case of Company 4. To recapitulate, value creation has been facilitated and enabled through enacting platform affordances. Table 6.2 provides a brief summary of platform affordances for knowledge-intensive service providers and consumer product manufacturers

Table 6.2: A Summary of Platform Affordances in Two Types of Firms

	Findings	Previous findings	Theoretical implications
Study 1 in Chapter Four	platform affordances: organisational memory affordance; product/service development affordance; collaborative affordance; opportunity discovery affordance	Using quantitative methods, current studies have examined organisational memory affordance and collaborative affordance for organisational innovation (Chatterjee et al., 2015, 2020); The affordance of real-time/flexible product and service creation is conceptually discussed (Zammuto et al., 2007)	Study 1 investigates four types of innovation platform affordances in knowledge-intensive firms in service industries, for which current literature falls short. This study provides conceptualised information of how four distinct platform affordances are enacted and benefit platform firms.
Study 2 in Chapter Five	Functional platform affordances: process management affordance, data-driven operation affordance, collaborative affordance, product development affordance; Relational platform affordances: transaction-leverage affordance, resource orchestration affordance, dynamic ambidexterity affordance	A relational view of affordances should take the socially constructed meaning embedded to the artefacts in its specific context (Zammuto et al., 2007; Faraj and Azad, 2012; Zheng and Yu, 2016). Some affordances are functional and more basic, which is influenced heavily by the material properties of the artefact, while other affordane are more related to users' needs and goals (Thapa and Sein, 2017).	Study 2 sheds light onto the relationship between functional affordances and relational affordances by exploring the role of functional affordances in facilitating the perception of relational affordances. It also examines how relational affordances could emerge by ascribing new meanings to IT artefacts according to users' changing goals, adding granularity and specificity to relational affordances.

6.2 Platform Affordances and Their Value Creation Mechanisms

Although distinct affordances in each research context are discussed in the preceding subsection, they create value in unique ways. In Chapter Four, the dataset shows that as the platforms develop, with enhanced technological capabilities and more value creation participants joining the platforms, the level of affordances can increase. This increased level of affordances influences the following behaviours taken in relation to value creation. Though some studies have discussed the evolving nature of affordance (e.g., Evans *et al*., 2016; Anderson and Robey, 2017), this thesis provides more nuanced information on affordance evolution based on empirical data: that is, how affordances evolve in relation to value creation activities.

For knowledge intensive digital organisations in Study 1, in the introduction stage, focal firms need to develop appropriate knowledge bases through arriving at the fit between core knowledge management teams have and codified knowledge through digital data and technologies, as well as customer knowledge through service provision. The basic organisational memory affordance plays a decisive role in determining the competitiveness of their marketing offerings and address the basic needs of clients on hand. When firms focus on long-term business and intend to scale and refine their business in the growth stage, focal firms find it imperative to collaborate with leading industrial enterprises to build legitimacy and reputation while obtaining their industrial knowledge and feedback for product development. Open innovation practices and boundary spanning activities are observed in the case firms to indicate more attention is paid to open collaborative innovation to prioritize growth and enter new markets for business expansion. During this process, they can add the content, components and functions to platforms to make their

products more useful through new business opportunity discovery. As affordances display enhanced levels, it means that platform firms can access an increased amount of both explicit knowledge and tacit knowledge based on wider and deeper collaborative ties. Therefore, it is possible to develop advanced customer offerings to better meet existing clients' needs and also expand product lines in more diverse application scenarios to serve customers in new markets.

Synergistic affordances − the synergistic effects of enhanced affordances – indicate that platform firms leverage accumulated domain knowledge and strategic knowledge to capture emergent or unfulfilled business opportunities for greater value creation in the emergent open innovation ecosystem. To ensure profitability, on the one hand, platform firms still need to advance their technology core and self-develop products to maintain control. On the other hand, they would selectively engage external partners for innovation (Gawer, 2021). Simultaneously, with joint product innovation and the perception of co-created value, focal firms are better positioned to convert extensive collaborative ties into an expanding open innovation platform ecosystem, which serves as a powerful new way of organising interdependent innovation activities (Yoo *et al*., 2012; Jacobides *et al*., 2018). Evidence demonstrates that innovation platforms function as a strategic and viable approach to open innovation because multiple entities can co-develop the innovation outcomes to serve their shared customers and also access customer feedback based on their usage. More important is that platform firms can effectively accelerate new product and service development while it would be difficult for rivals to imitate or copy market offerings that represent collaborative efforts in their open innovation ecosystem. As such, platform-enabled value creation can be effective to address often-cited challenges of

collaborative innovations – divergent goals (Almirall and Casadesus-Masanell, 2010) when involved stakeholders have opportunities to enlarge the allocated slices from a growing pie in an open innovation paradigm. Synergistic effects of synergistic affordances explain how platform firms can promote amplified value creation when more value creation participants contribute to the value of platforms in the emergent ecosystem (Nambisan *et al*., 2018; Hilbolling *et al*., 2019).

In the case of consumer product firms, enacting relational affordances with different value creation practices led to the three levels of digital servitisation as summarised in Table 5.2. These levels include product-oriented solution, smart connected solution and smart B2B service solution, which co-exist and develop with each other as relational affordances are continuously actualised. Specifically, the first level of digital servitisation is to bundle products and services mainly developed by the manufacturers to increase the customer utility or outcomes. Transaction leverage affordance can be enacted and result in the outcome of increased transaction opportunities through internal and external transaction platforms, while resource orchestration is mainly for effective integration, creation and use of organisational resources. Regarding dynamic ambidexterity affordance, the business opportunities are mainly focused on exploitative business to meet emergent needs of existing customers. Along with the first level of servitisation, the second level was observed, which connects with an expanding base of business partners, and include actors in its value chains to provide a complete solution to their existing and new customers in B2C markets. The focus of transaction leverage affordance is put on developing a two-sided platform, which can be open to collaborators and thus form an emergent business ecosystem organised around the product offerings. Meanwhile, firms

can leverage the resources and capabilities to develop exploitative services to serve both new and existing customers.

The third observed level of servitisation is developing and providing products and customised services based on companies' existing resources and capabilities to serve business customers. The focus of transaction leverage affordance at this level is put on a multi-sided platform with a growing number of service providers involved to increase transactions. Meanwhile, firms reshape the use of existing resources and capabilities to develop an emergent platform ecosystem; that is, like the business ecosystem organised around the product offerings, the platform ecosystem is organised around the platform to discover business opportunities of the platform, along with the existing nondigital resources. As such, the enactment of dynamic ambidexterity affordance mainly results in the provision of exploitative services to serve new business customers. The three types of affordances were appropriated through different ongoing and adaptive actions to serve the specific business goal for each level. This is in keeping with the Gibsonian idea that an affordance should remain relatively constant even if an actor's goals change.

Although prior studies have already pointed out the categories of services – basic, intermediate and complex (Kindström and Kowlkowski, 2015) – and three stages of product-oriented solution, integrated solution and smart connected solution (Fu *et al*., 2022), this study enriches the related literature by specifying the practices and complements the work of Fu *et al* (2022) by conducting a multiple-case study. Specifically, Chapter Five found that in addition to providing service to business partners, firms can exploit and repurpose their capabilities, digital assets and other nondigital resources to serve business customers, such as converting their capabilities and resources into market

offerings, or commercialising their self-served nondigital resources to other entities to expand the revenue streams. The identified levels of servitisation also enrich the analysis of the service variety and multiple business models as a portfolio within a firm (Martinez *et al*., 2017). The value creation mechanism shown in both knowledge-intensive digital ventures and established manufacturers is aligned with the logic that the platform owners can increase the depth of a platform to create new functionalities (exploitation) and expand the breadth of a platform to search for new sources of value and create new user bases (exploration) (Evans and Schmalensee, 2007). Table 6.3 summarises the impact of platform affordances on value creation.

Table 6.3: A Summary of Platform Affordances and Value Creation

	Findings	Previous findings	Theoretical implications
Study 1 in Chapter Four	Basic platform affordances; enhanced platform affordances; synergistic platform affordances, which could be exploited to realise value creation in order to grow business	The evolving nature of affordances (e.g., Evan *et al*., 2016; Anderson and Robey, 2017) has been discussed to some extent. Value creation of platform firms entail open innovation to promote contributions from value creation participants or complementors (Nambisan *et al*., 2018; Hilbolling *et al*., 2019).	Study 1 disentangles the evolution of innovation platform affordances using empirical data. Affordance evolution can not only increase the level of strength while being actualised but also promote interactive effects of affordances within an emergent open innovation ecosystem to achieve mutual benefits and enlarge the pie of value creation in open innovation processes.
Study 2 in Chapter Five	The same set of relational affordances are actualised by manifold practices, which lead to three levels of digital servitisation. These levels include product-oriented solution, smart connected solution and smart B2B service solution.	Previous studies have explored the categories of services -- basic, intermediate, and complex (Kindström and Kowlkowski, 2015), three stages of product-oriented solution, integrated solution and smart connected solutions (Fu *et al*., 2022), the journey to service (Martinez *et al*., 2017).	Study 2 provides insights into the actualisation process of relational affordances, and how ongoing and adaptive actions could lead to three levels of servitisation based on different types of services. This empirical study is aligned with the Gibsonian idea that an affordance should remain relatively constantly-even if an actor's goals change. The findings support that different practices in response to the same set of affordances would generate diverse outcomes.

6.3 Platform Development

The transformation of innovation platforms not only reflects the business goals at each stage but also presents how affordances enable platform firms to introduce products

and services and foster their innovations. Further, the driving forces behind their evolution were identified. At the inception of the platform setup, firms develop the initial products or services in-house by exploiting basic platform affordances to meet existing customers' needs and ease their pain points. After firms introduced their market offerings to market and served a limited number of clients, they focused on long-term business to provide innovative solutions to their existing clients alongside collaborating with more business partners to generate more value from exploratory business activities. To this end, platform firms need to develop deep and wide business relationships for open collaborative innovation to provide more customised solutions to cater to implicit and emerging customer needs while venturing into new markets across industries. The growth stage, termed as affordance ambidexterity (Lin *et al*., 2013) would enable firms to expand their business by expanding the reach and scope of collaborative ties, driving basic affordances to the next level (Evans et al., 2016). These collaborative ties form the basis of creating emerging open innovation ecosystems.

In line with Holgersson *et al*. (2022), who claimed that appropriate level of open innovation enable distributed value creation in ecosystems, collaborative innovation is also necessary to keep customers engaged while attracting more customers at the growth stage of platform development. Gradually when more customers join the platforms, on the one hand, focal firms can sense new business opportunities. On the other hand, they soon realise that more side members are needed to serve heterogeneous customer needs and capture new business opportunities in the emergent open innovation platform ecosystem, ultimately securing a larger share of profitability and progressing to the maturity stage. In other words, to realise profit-seeking business opportunities, focal firms need to integrate

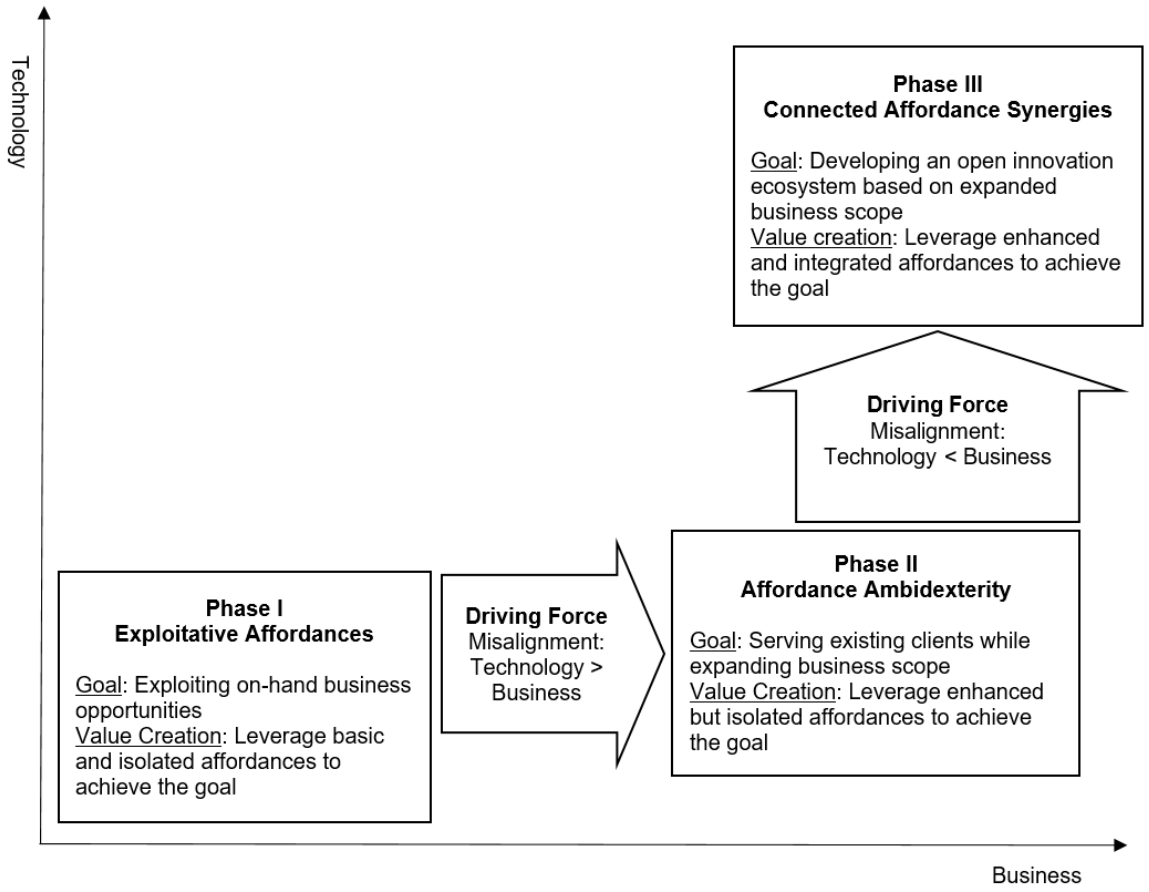
internal and external resources to develop continual service innovation and benefit from the synergistic effect of enhanced affordances. As such, the maturity stage is also labelled as connected affordance synergies.

The stage transition can be described as IT and business misalignments, driving the platform development from one stage to the next. The first IT and business misfit observed is that the commercial potential of platforms whose technological innovations acquired through digital assets cannot be fully exploited by only serving existing customers. To further grow their business by enhancing collaborative affordance, on the one hand, firms put the appropriate organisation design in place to facilitate collaborative ties; on the other hand, firms strive to enter new markets or industries and collaborate with target customers, such as leading companies, which could bring them industrial domain knowledge and reputation, as agreed by nearly all the case firms. Relative to other businesses driven by profit-generating purposes, they may pay more attention to the possibilities of product development with target customers, which can then serve others with the similar business scenarios in their industries. Consequently, with digital assets and capabilities developed over time, more functionalities can be added on platforms, or the development of complementary platforms can be done to create synergistic benefits.

However, despite the growing customer bases, over time, these knowledge-intensive companies soon discovered that they may not be capable of meeting the heterogenous needs of their clients, and they increasingly collaborate with business partners for innovation outputs to add to the utility of their customer offerings. This produces the second misfit of business and IT because their existing digital assets and capabilities alone may not suffice to fulfil the heterogenous needs of their existing

customers. As a result, an open innovation platform ecosystem can gradually be developed with the involvement of new customers and multiple business partners. Altogether, the platform development reflected by increased level of openness to business partners (Thomas *et al.*, 2014) can also be interpreted through affordance evolution (see Table 4.3), in line with platform firms' business goals in each phase. Thus, the findings contribute novel insights into innovation platform affordances and their evolution process for value creation, as summarised in Figure 6.1.

Figure 6.1: Innovation Platform Affordances in Value Creation and Evolution



In the case of manufacturing incumbents, digital platforms, such as IoT platforms, play a key role in enabling digital servitisation, which allows manufacturers to communicate with their physical products, and enable service development to customers.

Firms capitalise on innovation leverage and transaction leverage by setting up transaction platforms on their own or adding transaction functions on their apps. More importantly, each type of platform has opened up to business partners, which lead to the development of two-sided platforms, and then further evolve into multi-sided platforms as both business partners and customers are connected to reduce search cost and improve transaction efficiency. However, depending on the strategic goals of the focal firms, the scale and scope of multi-sided platforms differ. Specifically, to boost the firms' position in overseas warehousing services and help them become the JD.com of overseas, Company 1 developed an independent transaction platform to sell products from a growing number of non-competing firms. In most cases, the case firms developed a product ecosystem, selling products from other companies to complement the product use of their own. Regarding a product ecosystem, focal firms were observed to open up their IoT platforms to business partners, controlling partners' products as well to provide an overall solution for customers. By adding platform leverage logics, increasing the architectural openness, and developing other types of complementary platforms, the internal platforms gradually open up and work as a functional whole to support open innovations.

6.4 Digital Transformation

For manufacturing incumbents, in addition to the relational affordances as mentioned in the preceding subsection, this study illustrates that the importance of digital transformation for the subsequent servitisation efforts should not be underestimated. In this respect, Favoretto *et al*. (2022) identified several servitisation dimensions that digitalisation can affect through the literature review. Chapter Five extended this work by building relationships among several identified constructs such as motivation, service

offerings and structure. These constructs have been mostly studied independently. First, digital transformation could necessitate the implementation of new digital platforms and infrastructures that organisations rely on for day-to-day operations, and technology renewal involves changing not only technologies but also, and more importantly, their use (Wimelius *et al*., 2020). The case firms are thus able to directly and deeply involve digital technologies in value creation rather than functioning merely as a supporting role, which can be substantiated by the four functional affordances elaborated in the above. By enacting product development affordance to create smart, connected products (Porter and Heppelmann, 2014) with the integration of digital technology into physical products (Novales *et al*., 2016), this sets the tone for providing digital services. However, this transformation process could be thwarted by user resistance fuelled by a desire to continue using familiar structures and technologies (Polites and Karahanna, 2012). Polites and Karahanna (2012) further noted that user resistance may continue despite their perception of a new technology's relative advantage. Though it may be relatively easy for organisations to perceive these affordances, initially general employees expressed a status quo bias in which they 'disproportionally make decisions to continue an incumbent course of action, rather than switching to a new (potentially superior) course of action' (Polites and Karahanna, 2012, p. 23). Therefore, external support and internal commitment are two important forces to enable firms to benefit more from functional affordances in the digital transformation, a critical prequel to servitisation attempts. Such a prequel stage allows general employees to develop a familiarity with the platform referential totality by learning and developing the necessary skillset for the platform use, how their digitalised tasks fit with overall business processes and the new identity that the organisation has assumed.

During this stage, firms would reconsider the use of their developed resources and capabilities to expand revenue sources and expand business scope when appropriate. The process would arguably more easily bring about the attitudinal changes towards the customer-centric service model, inculcating a service culture, which involves changing the mindsets of hundreds or thousands of employees habituated to a product-centric vision because the mental model may be argued to be a primary barrier for product firms looking to gain from service offerings (Davies *et al*., 2006).

With the familiarity of digital platform whole and the deep embedment of digital platforms in value creation activities to support servitisation, relational affordances can thus be perceived. Importantly, the expanding familiarity of platform whole facilitates the use of firms' exaptation capacity: that is, repurposing existing and emergent resources and capabilities they can secure over time, and therefore, leading to multiple practised activities based on the same types of affordances. Given that the technologies are subject to interpretive flexibility, the requisite intertwining of technologies with human agency and use contexts produces unpredictable discrepancies between intended and actual practices (Orlikowski, 1992), and these adaptive actions could narrow the gap between intended and actual practices. This explains that in reality, the different extent of organisational capabilities emerging from the affordances and their actions can enable firm to attain competitive advantage to various degrees. Such an argument is supported by previous competitive dynamic research, showing that firms with varied action repertoires often outperform rivals (Derfus *et al*., 2008; Ndofor *et al*., 2011). Table 6.4 outlines the key theoretical implications related to the impact of digital transformation on servitisation.

Table 6.4: A Summary of the Impact of Digital Transformation on Servitisation

	Findings	Previous findings	Theoretical implications
Study 1 in Chapter Four	Basic platform affordances; enhanced platform affordances; synergistic platform affordances, which could be exploited to realise value creation in order to grow business	the evolving nature of affordances (e.g., Evan *et al*., 2016; Anderson and Robey, 2017) has been discussed to some extent. Value creation of platform firms entail open innovation to promote contributions from value creation participants or complementors (Nambisan *et al*., 2018; Hilbolling *et al*., 2019)	Study 1 disentangles the evolution of innovation platform affordances using empirical data. Affordance evolution can not only increase the level of strength while being actualised but also promote synergistic effects of affordances within an emergent open innovation platform ecosystem to achieve mutual benefits and enlarge the pie of value creation in open innovation processes.
Study 2 in Chapter Five	The same set of relational affordances are actualised by manifold practices, which leads to three levels of digital servitisation. These levels include product-oriented solution, smart connected solution and smart B2B service solution.	previous studies has explored the categories of services -- basic, intermediate, and complex (Kindström and Kowlkowski, 2015), three stages of product-oriented solution, integrated solution and smart connected solutions (Fu et al., 2022), the journey to service (Martinez *et al*., 2017).	Study 2 provides insights into the actualisation process of relational affordances, how ongoing and adaptive actions could lead to three levels of servitisation based on different types of services. This empirical study is aligned with the Gibsonian idea that an affordance should remain relatively constant-even if an actor's goals change. Our findings support that different practices in response to the same set of affordances would generate different outcomes.

6.5 Capability Development

A handful of studies have proposed several organisational capabilities to manage the servitisation, such as service design capabilities to successfully implement service transition strategy (Alghisi and Saccani, 2015) and the data collection capability allows for insights into service-related consumer behaviour based on the data collected on their products/service use. In this regard, Parida *et al*. (2014) identified four distinctive capabilities needed to facilitate the servitisation transformation, namely, business model design, network management, integrated development and service delivery network management. However, the identified capabilities are mainly from industrial product manufacturers, and these studies do not take into account the activities that different firms take to achieve servitisation, thus there could be variations of developed capabilities.

In response to the limited understanding of strategic capabilities that push consumer product companies towards digital servitisation (Kohtamäki *et al*., 2019), Chapter Five

identified three organisational capabilities pertinent to platform-enabled servitisation in consumer product firms, which can be developed through the exaptation mechanism in a familiarity of digital platform totality. Building upon and extending the claim of Thapa and Zheng (2019) that on some occasions we could equate capabilities with affordances, this study uncovers the mechanism of exaptation where affordance actualisation leads to capability development. New organisational capabilities can be developed through continual enactment of relational affordances because capabilities should have achieved some threshold of practised activities before reaching a high possible degree of functionality (Helfat and Peteraf, 2003). The capability development also echoes the claim that organisational capabilities are unique and idiosyncratic to a firm (Nayak *et al*., 2020).

Consequently, firms could make their servitisation successful through continuous service innovation for greater value creation. Specifically, dynamic ambidexterity capability is at the core of introducing service business from which customers perceive and derive value. This capability is in line with the IT proactive stance capability proposed by Lu and Ramamurthy (2011) and used by Sadreddin and Chan (2022) as one important IT-enabled organisational capabilities through actualising digital affordances. The dynamic ambidexterity capability proposed herein highlights both explorative and exploitative business opportunities that are proactively or unintendedly searched. In case of resource orchestration capability, accessing all possible forms of internal and external resources through platforms plays a foundational role in creating and reshaping market offerings. Besides, the offerings were observed to be interrelated with platform development through extending and creating digital assets and digital affordances. Resource orchestration capability therefore also explains how platforms and ecosystems emerge and develop along

with the levels of servitisation. In this aspect, detailed insights are provided into specific resource orchestration actions when an internal platform transitions to an external platform (Chen and Cui, 2022). Relative to the previous capabilities, transaction leverage capability is critical for consumer product firms to capture value. As noted, in addition to the transaction platform, innovation platforms can develop modules to promote transaction opportunities, affording reintermediation, ubiquity and disintermediation (Autio, 2017). By identifying transaction leverage capabilities, resource orchestration capabilities and dynamic ambidexterity affordance, the unique dataset and related results illustrate how the capabilities together drive the value creation and value capture in the context of digital servitisation. Therefore, an integrative theoretical model illustrated in Chapter Five constitutes one of the important contributions to the literature at the intersection of platforms and digital servitisation. The following Table 6.5 provides a synopsis of capability development in servitised consumer product firms.

Table 6.5: Capability Development in Consumer Product Manufacturers

Findings	Previous findings	Theoretical implications
Three organisational capabilities are identified in pursuit of servitisation. That is, transaction leverage capability, resource orchestration capability and dynamic ambidexterity capability, which can be developed from actualising their corresponding relational affordances.	Thapa and Zheng (2019) pointed out that on some occasions we could equate capabilities with affordances, particularly those affordances that are socialised through social practices and process (Zheng and Yu, 2016). Sadreddin and Chan (2022) utilised affordance theory to examine how digital affordances can facilitate the development of identified capabilities in literature. Some studies identified related capabilities to facilitate servitisation in industrial product manufacturers (e.g., Parida *et al*. 2014; Alghisi and Saccani, 2015)	Study 2 explains why the identified organisational capabilities are important in the context of servitised consumer product manufacturers, for which current literature shorts fall. Importantly, through examining how organisational capabilities can be developed from relational affordances, it also reveal the mechanism of affordances could equate capabilities. Therefore, by providing an empirical analysis, Study 2 support the claim that organisational capabilities are unique and idiosyncratic to a firm (Nayak *et al*., 2020).

6.6 Concluding Remarks

Data collected in this thesis demonstrate the impact of digital platforms on the development of customer offerings and how the evolution of affordances would affect

value creation dynamics in both knowledge-intensive service providers and more traditional manufacturers. Specifically, drawing on an affordance perspective, based on the specific business goals and contexts, distinctive platform affordances are identified. To leverage innovation platforms for product and service development, knowledge-intensive firms prioritise open innovation and involve both clients and business partners on platforms. Four types of affordances – organisational memory affordance, product/service development affordance, collaborative affordance, and opportunity discovery affordances – are discussed for value creation. The misalignments between the platform capabilities and the fulfillment of customer needs become visible, and this motivates ventures to make efforts to evolve their platforms, with the result of generating increased level of affordances. Also, platform firms could leverage the synergistic benefits of those affordances as the enhanced affordances interact with each other, thus enabling continual service innovation within an open innovation platform ecosystem.

However, matters are more complicated in established consumer product firms. Though these firms may possess more financial resources than new digital-born ventures, they could face a status quo bias to continue an incumbent course of action due to organisational inertia and employee resistances, therefore, interpreting through the Heideggerian thinking, considering the adoption of digital platforms as ready-to-hand is important to have a digital platform holism. That is, organisations exploit functional affordances to support digital transformation with the external support and internal commitment. Consequently, general employees acquire a knowledge of platform value and affordances, the corresponding tasks, and the reshaped organisational identity, which is the development of a familiarity with digital platform totality. The perception and enactment

of product development affordance could lay a foundation for future service offerings after firms repurpose their existing digital assets and resources.

After firms embark on digital servitisation, three types of relational affordances are identified, and their actualisation leads to the development of three corresponding organisational capabilities. Though Sadreddin and Chan (2022) mentioned capabilities are the outcome of actualised affordances, this study complement that research, arguing that the capabilities are the outcome of repeated affordance actualisation along with the increased level of a familiarity with the platform referential whole in servitised contexts and the resulting capacity for exaptation. The capabilities could in turn lead to the effectiveness of actualised outcomes, which explains the variation of servitisation outcomes with the same adoption of digital platforms and the enabling technologies.

CHAPTER 7 CONCLUSIONS, CONTRIBUTIONS AND FUTURE RESEARCH

Platforms can capitalise on a multi-logic architectural leverage, tapping into multiple platform leverage logics and increasing platform openness to bring benefits to actors in ecosystems (Thomas *et al*., 2014). It is therefore imperative for platform firms to transition towards more open collaborative innovation mode by integrating internal and external resources and capabilities to develop new offerings. Meanwhile, although studies have recognised that platforms evolve over time, and then affect the solutions that firms can provide to customers, such complex interrelatedness is largely overlooked in the existing literature. Besides, based on the literature review, less is known regarding the early stages of platform development (Shi *et al*., 2021). This study thus adopted an interpretive approach to empirically explore the development of marketing offerings in two types of companies: digital-born knowledge-intensive service providers and consumer product manufacturers. Based on the discussion, this final chapter re-evaluates the research questions proposed in the literature review to address the overarching question: *How do digital platforms enable value creation in service and manufacturing industries?* An overview of two studies is provided in Table 7.1 before presenting the detailed concluding section, which includes research questions, contributions, limitations, and future direction.

Table 7.1: An Overview of Two Studies

	Study 1	Study 2
Research motivation	Platforms are used to engage customers and third parties for innovation. Existing literature is mainly focused on transaction-driven platforms (e.g., social media, crowdsourcing platforms) in the context of open innovation. To complement the literature, Study 1 examines self-developed innovation platforms and explores their impact on value creation when firms expand their business and develop platforms.	The current body of literature on digital servitisation primarily emphasises the role of digital platforms in B2B contexts, specifically within the industrial manufacturing sector, with a focus on their technological capabilities. Study 2 therefore examines digital platforms in consumer product manufacturers and investigates the value creation opportunities proffered by digital platforms as firms implement a platform approach to digitally transform and servitise their business.
Platform characteristics	Highlight innovation leverage to achieve economies of innovation and complementarity, thus facilitating the creation of new market offerings; Transition from internal innovation to introduce initial offerings to more open collaborative innovation, forming an open innovation ecosystem	Highlight multiple platform leverage (e.g., innovation & transaction leverage) to promote innovation and create efficient transaction opportunities to reach more customers; Transition from an internal production platform to more open digital platforms to develop different levels of digital servitisation
Methodology	Multiple case study with inductive reasoning	Multiple case study with abductive reasoning
Key findings	Four innovation platform affordances: organisational memory affordance, product/service development affordance, collaborative affordance and opportunity discovery affordance were identified. As firms adopt different innovation strategies to cater to specific needs in each platform development stage, affordances can also evolve when firms can access and integrate resources from an increasing number of value creation participants. Meanwhile, IT-business misalignments have been identified as the driving forces of the platform development.	Study 2 identifies two sets of affordances that come into play − functional affordances and relational affordances when traditional consumer product manufacturers become a solution provider. Given the organisational inertia and the necessity to transform the identity of manufacturing companies, functional affordances, which are relatively easier to perceived and actualised, can help develop a digital platform totality from the Heideggerian perspective. It was observed that relational affordances can emerge, and these affordances were realised in various ways as firms repurposed their resources and capabilities. Ongoing and adaptive actions not only enable firms to develop distinctive capabilities but also lead to increased service performance.

Implications	Study 1 enriches the literature on three fronts. First, it contributes to affordance literature by applying it in an under-explored innovation platform-related context through identifying four relevant affordances. Second, it explores innovation platform development process, and uncovers how value creation unfolds to meet firms' specific goals in each stage. Third, it extends IT alignment literature by examining how misalignments emerge at each stage and are fixed as firms' business and their innovation platforms coevolve.	Study 2 contributes to the literature on three fronts. First, this study offers novel insights into the nascent research on digital servitisation in consumer product incumbents. Second, it provides an integrative framework, connecting and empirically validating previous disconnected concepts of 'familiarity', 'referential whole', 'affordance' and 'exaptation'. Third, it provides an alternative view of how distinctive organisational capabilities can be developed as firms adopt a platform approach to realise their organisation-wide goals.
Limitations	Like other qualitative studies, it has the issue of generalisability. Meanwhile, it would be appropriate to concede that the analysed cases do not necessarily reflect the best practices, the full spectrum of possible evolutionary journeys a platform may undertake for service business development, or the entire range of affordances it can offer. Data collected for Study 1 was from the platform firms' perspective and interviewed firms are not full-fledged platform firms, which cannot be capable to provide sufficient information concerning the maturity stage of platform development.	Study 2 has the issue of generalisability due to its qualitative nature. It would also be appropriate to concede that the analysed cases do not necessarily reflect the best practices, the full spectrum of possible levels of servitisation a platform may undertake for service business development, or the entire range of affordances it can offer. Similar to the limitation in Study 1, with regards to the advanced level of digital servitisation in Study 2, most firms are still far from reaching maturity.
Future research directions	Future research is encouraged to explore how affordances come into play and evolve in firm's established platform ecosystems, for example, enabling them to shape business model portfolios.	Future research is needed to provide rich insights into how the roles of third-party platforms and self-owned platforms can assist and interact with servitized manufacturers in achieving their goals.

7.1 Conclusions from Research Questions

7.1.1 Conclusion from RQ 1: *What are the affordances of innovation platforms in knowledge-intensive service providers?*

This RQ aims to unveil the possibilities or opportunities that innovation platforms could afford to focal firms. Results indicate that four types of affordances – organisational memory affordance, product/service development affordance, collaborative affordance and opportunity discovery affordance – are pertinent to enable value creation. As noted, the development of product/service offerings, even the platform development is the outcome of open innovation models. Through leveraging boundary resources, platform firms can integrate with external databases, which can generate knowledge through application of innovative technologies (e.g., AI, big data analytics), which constitute the starting point to exploit the commercial value through setting up the platform. Given that their platform and customer offerings at the early stage need updates to make them more relevant to real business scenarios, focal firms take initiatives to collaborate with leading firms to build the legitimacy and reputation, while also securing their domain of knowledge. When a service provider develops customised solutions to business customers, they are more willing to share their pain points and industrial knowledge with the hope of developing customised offerings and reaping greater benefits from the use of provided solutions. In addition to customers, focal firms find the platforms to be a viable tool to collaborate with business partners, because the focal firms and business partners could co-develop an overall solution to serve their shared customers through accessing an established group of customers. Because of the layered modular IT architectures that feature openness, generativity and modularity, product/service development affordance can be enacted through developing

new modules and remixing existing modules based on accumulated knowledge and perceived business opportunities. The fourth affordance identified is opportunity discovery affordance, which can be realised through voluminous digital data and other digital assets, recognising visible and latent business needs of potential and existing customers, and through business partners via project engagement to expand the business scope they can serve.

7.1.2 Conclusion from RQ 2: *How do innovation platform affordances empower service providers to create value for clients?*

The identification of affordances could already provide a clue to how value creation underlies the development of customer offerings. Based on how affordances create value for clients, three stages have been respectively labelled as: exploitative affordance, affordance ambidexterity, and connected affordance synergies. At the inception of the platform setup, firms develop the initial products or services by exploiting basic platform affordances to meet existing customers' needs and ease their pain points, which mainly rely on internal innovation. Accordingly, on the introduction stage labelled as exploitative affordances, basic affordances are actualised by platform firms to capture on-hand business opportunities. After firms introduced their market offerings to market and served a limited number of clients, they focused on long-term business and engage in more open innovation iniaitives to provide innovative solutions to their existing clients while collaborating with more business partners to generate more value from exploratory business activities. The growth stage thus features value creation enabled by affordance ambidexterity (Lin *et al*., 2013). At the maturity stage, in which firms provide further innovative services within an emerging open innovation ecosystem, continual value creation is thus possible through the

synergistic effects of enhanced affordances to serve a larger customer base and capture emergent business opportunities, which is referred to as synergistic affordances. Correspondingly, the third stage labelled as connected affordance synergies, refers to the synergistic effects from those enhanced affordances, which are stronger than the sum of the effects of the individual enacted affordances.

This question also unearths the evolutionary dynamics of affordances for enhanced value creation. Moving from Phase I to Phase II, firms grow their customer base with offerings based on the initially acquired technological resources and capabilities to tap into their full commercial value; while at the later stage of Phase II, because technological resources and capabilities cannot readily meet product and service development for the expanded business scope that firms envision to materialise, in addition to open innovation through collaborating with clients, platforms were observed to expand open innovation engagement by increasingly collaborating with business partners to have joint product/service development. Gradually, an open innovation ecosystem can be orchestrated. As such, the IT and business misalignments were observed to be driving forces of platform evolution, leading to affordance evolution at the same time.

7.1.3 Conclusion from RQ 3: *What are the affordances of digital platforms in servitised manufacturers?*

This question identifies the types of affordances and the link between property-driven function affordances and value and capability-driven relational affordances. For consumer product firms that intend to venture into service space, they should never underestimate the role of their prequel stage: digital transformation. In this stage, aided by external support of technology suppliers and internal commitment (e.g., top management

support), four functional affordances – process management affordance, data-driven operation affordance, collaborative affordance and product development affordance – were perceived and enacted in the course of digital transformation. The aforementioned affordances are seen as functional affordances because they do not support 'a values-oriented analysis of IT artifacts' (Markus and Silver, 2008, p. 622), which means the affordances are discovered from the platform use due to their material properties without further depending on their developed capabilities and constructed interpretation. The combined effects of three functional affordances contribute to product development affordance, and the enactment of product development affordance increases the importance of digital technologies in product development. This leads to the design of smart products and reshapes value creation through service provision (Raff *et al*., 2020).

The preparedness of digital assets and other nondigital resources, along with the acquisition of a familiarity with digital platform whole, empowers firms to perceive relational affordances to push their digital servitisation forward. Three affordances are found pertinent to consumer product firms: transaction leverage affordance, resource orchestration affordance and dynamic ambidexterity affordance. Transaction leverage affordance matters because new customer interfaces could be created on platforms, which could open to complementary business partners with the aim of reducing customers' search cost and improving transaction efficiency. The enactment of resource orchestration affordance is facilitated by platform firms' position as platform owner and orchestrator in value chains through externalising their own resources and capabilities (Eloranta and Turunen, 2016). Besides, based on data-driven operation affordance, internal resources can be effectively managed, and established manufacturers may possess financial resources to

establish different types of collaborative ties, such as merger and acquisition, and this in turn enriches their resource base through platform integration. Dynamic ambidexterity affordance allows focal firms to perceive and fulfil both exploratory and exploitative business opportunities to continuously expand customer base and maintain competitiveness. Though similar to opportunity discovery affordance identified in digital ventures, dynamic ambidexterity affordance stresses established firms with a relatively high degree of entrepreneurial resources (e.g., finances) to take the initiative in experimenting with business attempts through the platform approach. Altogether, the three complementary affordances contribute to continuous value creation and capture from servitisation efforts.

7.1.4 Conclusion from RQ 4: *How do platform affordances empower manufacturing firms to pursue servitisation?*

By benefitting from these functional affordances, organisations can develop a familiarity with platform referential whole, that is, the background knowledge of the platform use, a set of interrelated tasks fulfilled on different types of platforms and the new organisational identity they assume as a technology-oriented manufacturer. That is, general employees develop their skillset of digital platforms and understand their relationships to existing digital assets and nondigital resources along with the new identity organisations assume. This would potentially eradicate the organisational inertia (Mikalef *et al*., 2021), increase the sensitivity to perceive new relational affordances, and have them actualised through multiple activities after firms devote their resources and capabilities in new applications through exaptation. The capacity for exaptation contributes to devoted endeavours to advance levels of servitisation in case firms.

Consequently, these actualised affordances facilitate the development of transaction leverage capability, resource orchestration capability and dynamic ambidexterity capability. This is in line with the prior finding that capabilities are the outcome of actualised affordances (Sadreddin and Chan, 2022). With the developed capabilities, firms would enact the affordances more effectively through corresponding activities. By integrating the notions of familiarity, referential whole, affordances, and exaptation mechanism, this study followed the non-cognitive/tacit nature of organisational capabilities (Nayak *et al*., 2020).

7.2 Contributions

7.2.1 Theoretical Implications

By drawing on technology affordance theory, this thesis provides a novel and holistic picture of platform-enabled value creation, which can complement existing platform literature that has under-used established theories based on the literature review in Chapter Two. Affordances highlight the double dance of users (e.g., specific goals or capabilities) and platforms, justifying why the same technologies can be applied in different ways and yield divergent final outcomes. Therefore, the thesis explains how platform affordances emerge and change and render competitiveness to digital-born service providers and servitised manufacturing incumbents, both of which encounter challenges beyond the platform adoption. Importantly, affordances have been suggested by prior literature to link with concepts such as organisational capabilities, and digging into the underlying relationships could add more nuanced information on why platform and affordance evolve over time and help firms achieve organisational goals. The following subsections present the theoretical contributions in more detail.

Chapter Four contributes to the innovation platform research on three fronts. First, this study sheds new light on the nascent research on innovation platform development and the emergence of open innovation ecosystems. Previous studies have largely focused on analysis of platform ecosystem and complementors, without paying much attention to the factors that trigger platform evolution along with the underlying value creation mechanisms. Given that the existing studies offer a partial account of the platform firms' efforts at the platform evolution and a number of researchers are more interested in the evolvability of platform ecosystems for value creation (e.g., Schreieck *et al*., 2022), the findings focus on early stages of platform development and untangles driving forces as platforms move from one stage to the next.

Second, the findings reveal four distinctive types of innovation platform affordances for value creation. Study 1 extends the affordance literature by demonstrating how levels of affordances increase and how affordances work with each other in the maturity stage, enabling enhanced value creation and platform development. For example, over time when existing customers perceive the additional benefits from newly added product functionalities, customers are more willing to share industrial knowledge and their ideas with platform firms. These products would become more competitive and relevant to new customers in the same application scenarios. This drives basic affordances to the next enhanced levels. After new products are introduced to serve the existing customers while exploring new markets, to create more value and further expand the business scope, platform firms need to recognise and capture the business opportunities from the growing number of customers and from potential business partners in different projects.

Consequently, platform firms can bring more side members on board. These value creation contributors thus enlarge the open innovation platform ecosystem.

Third, the finding contributes to the IT alignment literature by examining how misalignments emerge at each stage and are fixed as firms' business and their innovation platforms coevolve to create and maintain competitiveness. Prior studies on IT alignment have pointed out that misalignment or weak alignment between IT and business strategies can impede firm performance (Queiroz *et al*., 2020; Tallon, 2011). This study confirmed that IT misalignment is something firms should avoid; however, misalignments identified herein can also be seen as a blessing in disguise and a signal that firms need to progress to the next stage by having appropriate organisational design (e.g., a training system for implementation consultants) in place and increase the level of open innovation engagement to capture business opportunities and maximise value creation.

Chapter Five makes four important contributions to related literature by disentangling platform-enabled servitisation. First, this study offers novel insights into the nascent research on digital servitisation in consumer product incumbents (Kreye and van Donk, 2021). Previous studies have largely focused on digital servitisation in B2B settings due to the greater importance attached to buyer–supplier relationships (Kamalaldin *et al*., 2020). In doing so, they provided incomplete insights on how consumer product manufacturers can implement digital servitisation, especially given the different types of service businesses in consumer and industrial markets. Specifically, Study 2 looks at the role of different types of platforms besides IoT platforms, and how such platforms co-present and co-develop towards open innovation platforms and how organisations behave to capture their synergistic benefits to advance the growth agenda. Further, by identifying

dimensions of digital servitisation at three levels of servitisation, this study articulates the activities supported by digital platforms at each level. Specifically, the study contributes to platform development literature by looking at the nascent development of how internal production-oriented platforms progress into open innovation platforms through increasing their architectural openness, adding platform leverage logics and developing other types of platforms for each level of servitisation.

Although prior studies have emphasised the use of digital technologies in enabling service business, such as identifying common faults and reducing fault occurrence (Naik *et al*., 2020), and exploring the effects of platforms' modular architecture and system integration on addressing complexities and challenges in servitisation (Fu *et al*., 2022; Eloranta *et al*., 2020), the aforementioned use is more related to functional affordances. Other than this, these studies do not delve deeper into other effects the technologies can exert from their usage. This study is distinguished from prior studies in which it showcases that functional affordances and their actualisation with internal and external support set the stage for digital servitisation in terms of not only technology readiness, but also an organisation-wide familiarity with platform totality. Consequently, relational affordances would be perceived and actualised in the pursuit of digital servitisation. This finding supports previous studies arguing that digital servitisation goes beyond a mere amalgamation of two concepts, instead representing an integrated whole (Frank *et al*., 2019). Digital servitisation brings about structural and human implications (Baines *et al*., 2017).

Second, this study contributes novel findings that enrich affordance literature through developing an integrative framework by connecting and empirically validate

previous disconnected concepts of 'familiarity', 'referential whole', 'affordance' and 'exaptation'. In line with Lanamäki *et al*. (2015), who increased granularity and specificity of the affordance concept with Heideggerian concepts, endeavours are also made to examine the perception and actualisation of relational affordances. Different from function affordances that are derived from material properties of platforms, some of relational affordances' perception and actualisation are not as simple as the relation between the actor (with goals and capabilities) and an artefact (with features) (Bernhard *et al*., 2013; Pozzi *et al*., 2014). Instead, the emergence of some relational affordances is closed related to the familiarity of competent and goal-directed actors with equipment in totality, which could be acquired from the actualisation of functional affordances. Meanwhile, following the concept of affordances-for-practice (Zheng and Yu, 2016), the same relational affordances could be enacted by different practices. That is, empirical evidence shows that manifold actions would be taken to realise one affordance because organisational actors have developed a familiarity with platform totality and repurpose their resources and capabilities after endowing them with new meanings. Affordances, actions and their purpose reinforce each other and co-constitute a referential whole (Riemer *et al*., 2017). Following this logic, the empirical data in Study 2 illustrate that technology affordance is a generative response, and its constituents of technology, action and role of platform actors are inseparable, emergent and co-evolving (Faraj *et al*., 2011).

Meanwhile, the empirical evidence corroborates the relationship between a deep familiarity with platform referential whole and exaptation, which has been implicitly expressed in the work of Nayak *et al*. (2020). Though exaptation has been widely associated with innovation (e.g., Codini *et al*., 2022; Beltagui *et al*., 2019; Andriani and

Kaminiska, 2020), this mechanism has not been combined with a familiarity of the platform whole and affordances in the context of digital servitisation. This study extends related literature by presenting a process model and highlighting how these notions come into play to push servitisation efforts forwards. Specifically, on top of the acquired familiarity of platform whole, digital transformation allows firms to acquire resources and technological capabilities, which creates conditions for an exaptation capacity. It is the exaptation that drives companies to continuously evolve their platforms and explore new values from affordance actualisation, resulting in different levels of servitisation. Their interrelatedness explored here constitutes one of the contributions to the literature. As such, by supporting Osmundsen *et al*. (2022)'s claim that the notions of familiarity and referential totality can help firms perceive affordances, Study 2 proposes that the exaptation mechanism eventually leads to continuous enactment of the affordances. The exaptation mechanism discovered in the servitisation path echoes Martinez *et al*.'s (2017) finding that the service journey is emergent and evolutionary rather than structured or logical.

Third, based on the findings that multiple different actions would be taken to realise one affordance as organisational actors have developed a familiarity with platform totality, this study unravels the relationship between IT affordances and organisational capabilities. To appropriate relational affordances, ongoing, adaptive actions (as summarised in Table 5.2) have been taken by manufacturers to enact emergent relational affordances to expand the service business in scale and scope. This process is enabled by the firm's capacity for exaptation – repurposing resources and capabilities firms can access and amass over time. The exaptation mechanism is also facilitated with the expanding familiarity of platform referential whole as firms embark on the platform-enabled service business. New

organisational capabilities that are developed through skilled, adaptive actions in turn allow focal firms to act on affordances effectively, which could lead to superior actualised outcomes. Thus, the exaptation mechanism combined with the development of new organisational capabilities justify a sustainable competitiveness advantage that some firms can attain while others cannot. However, this observation does not imply that the strength of these capabilities is similar, because actualising those affordances depends on the resources and actions, as well as the extent of repurposing in each company. This situation is more reflective of the real-world cases that organisational capabilities could have varying degrees rather than 'have it or not' (Barreto, 2009, p. 270). Organisational capabilities built from within this process explain its in-imitable and tacit nature, leading to a competitive advantage that is hard to lose (Krasnikov and Jayachandran, 2008).

7.2.2 Managerial Implications

First, the findings offer practical implications for knowledge-intensive service providers using innovation platforms to generate strategic value and expand their business. This research suggests that value creation can be achieved by exploiting platform affordances – organisational memory affordance, product/service development affordance, collaborative affordance and opportunity discovery affordance. Specifically, service providers need to evolve the affordances with a growing number of partners and customers engaging in innovation activities. Specifically, managers should be more focused on internal innovation to develop the technological foundation and ensure its ownership. This would potentially grant platform organisation a relatively strong appropriate regime to start their business, which may be particularly relevant to knowledge-intensive business service. When firms embark on the growth stage, managers need pay more attention to

implementing appropriate open innovation practices to scale and refine the business across industries, such as joint IP and even leave the product ownership to clients to enter new markets. When in the maturity phase of the platform, managers prioritise profitability and would combine both internal and open innovation approach to further develop or upgrade their platforms and increase the value of their open innovation ecosystems as a whole (Gawer, 2021).

Meanwhile, firms can increase their levels of strength (Evans *et al*., 2016), evolving from basic to synergistic affordances to create greater and ongoing value. As expected, firms exploring technology affordances would generate more value on the condition of the synergistic effects of enhanced affordances. In other words, the findings of Study 1 not only inform platform firms that the significance of platform ecosystems is not just product and service development, but also encourage them to develop a chain of value creation. The strategic knowledge accumulated can provide a guideline on with whom to collaborate, what product and service to offer and when it is appropriate to fulfil new business opportunities to enter new business lines or even innovate their business model. In addition, managers need to take initiatives and explore the diverse application scenarios through different types of collaboration ties, which could create a growing pie when innovation opportunities arise. The proposed model may also enable managers to assess their platform firm's status quo in the platform development process, and plan in advance strategic moves such as appropriate organisational design to cope with potential IT–business misalignment identified in the study.

This thesis also provides practical implications for consumer product companies striving to develop service offerings. First, through the use of platforms and digital

technologies, digital transformation not only allows firms to optimise process, improve efficiency through data-driven operation, build collaborative ties and drive effective product development based on customers' demanding requirements, but also enables them to develop a familiarity of platform totality. The trainings should be constantly provided to employees at different level to perceive and leverage functional affordances, which are often designed by the platform developers. As organisational members increase their level of platform use, reflected by the platform totality and the new formed organisational identity, they would be more likely to perceive and leverage second-order relational affordances, thus achieving and clarifying the servitisation goals along with traditional businesses.

Given the above, managers should pay attention to how employees across departments perceive the platforms in relation to their tasks, how they are related to tasks performed by others, the purposes of their tasks – how these tasks contribute to the identity firms assume and their organisational goals in performing them. In other words, knowing how to use platforms by organisational actors is not enough; management teams should pay continuous attention to whether such familiarity has established, which may take a longer period than knowledge acquisition of platform usage. Importantly, the new identity in the referential whole also play an essential role in reducing barriers the organisations would encounter in the pursuit of organisational changes (Brown and Starkey, 2000).

Second, it is necessary to ensure that firms form organisational capabilities, which would make their servitisation successful over time, actualising relational affordances through the exaptation mechanism. Developing relational affordances often requires the presence of other people and objects, and could promote collective actions to realise their

organisational-level goal. Besides, as general employees across departments develop a skillset of digital platforms and understand their relationships to other components in the organisation (e.g., digital assets and nondigital resources), relational affordances perceived in response to new strategic visions could make more sense to them. As a result, firms can easily engage in exaptation of their developed processes, skillsets, resources and capabilities. Therefore, it is natural for them to perform a set of ongoing, adaptive actions to fully actualise affordances in response to strategic changes, while building up a set of organisational capabilities.

7.3 Limitations and Future Research Opportunities

Like other research, this thesis has potential limitations, some of which open up future research opportunities. Two studies have two shared concerns. One is the issue of generabilisability due to its qualitative nature, and the other is that it would be appropriate to concede that the analysed cases do not necessarily reflect the best practices, the full spectrum of possible evolutionary journeys a platform may undertake for service business development, or the entire range of affordances it can offer. Specifically, data in Study 1 were collected from the platform firms' perspective. Nevertheless, the identified affordances could be relevant to perceive other types of affordances from clients' or business partners' points of view, such as how platform firms' stakeholders perceive and enact affordances via the platforms. Data collection from the platform level could result in a more holistic picture of platform-enabled value creation dynamics. Moreover, the researcher believes that the method of investigating four types of affordances and their evolution in Study 1 highlights a promising research avenue. For example, half of the case firms are only in the active preparation of transitioning into the maturity stage, while the

other half are at the early stage of maturity. Therefore, it may represent another limitation, which can be potentially addressed by interviewing full-fledged platform firms with established ecosystems to see how synergistic affordances can interact to innovate market offerings. Therefore, how affordances affect the value creation in the established open innovation platform ecosystem opens up for future enquiries.

For consumer product firms, case studies were conducted in established large incumbents. Though the results can provide guidelines to other B2C companies of varying sizes, this study suggests that research contexts would be taken into account and the finding can be a springboard to inspire other emergent types of affordances to help firms with their organisational goals, such as how SMEs use digital platforms to pursue servitised business models. Besides, it is significant to compare the affordances that firms can leverage from using self-developed platforms and third-party platforms to achieve their goals. Likewise, though some firms have transitioned into the third stage of platform development in Chapter Four or advanced level of digital servitisation in Chapter Five, most firms are far from reaching maturity. Thus, insights into value creation activities as they progress further to ensure the continuity of the platform are needed from future research.

Besides, Chapter Five looked at the enabling role of affordances in the emergence of organisational capabilities. According to affordance theory, affordances can both enable and constrain certain actions. For example, digital technologies such as IoT technologies afford real-time information and automatic updates in digital transformation, but given the fast pace of technology development, new digital technologies can also bring role ambiguity and unsettling changes (Tim *et al*., 2020). Hence, future research is encouraged to provide a more holistic view of how affordances can enable and constrain the activities,

which may provide more relevant practical implications. Similarly, a more complete understanding can be developed by looking at cases of both successes and failures of firms operating digital platforms to enable capability development.

Last but not least, though it is clear that value creation is made possible through the actualisation of identified affordances, both Chapter Four and Chapter Five have not considered the overall level of strategic or economic benefits that these affordances create for focal firms. Meanwhile, given that organisational capabilities are identified as an essential role in the IT–innovation link (Chatterjee *et al*., 2015), future studies are needed to assess the level of contribution offered or generated by each affordance along with organisational capabilities and other contingencies using quantitative methods to quantify innovation performance. The aforementioned research opportunities are summarised in Table 7.2.

Table 7.2: Future Research Opportunities

Future research opportunities	
Types of technologies	Other types of technologies can be investigated, such as the application of blockchain technologies and cloud computing, and how different technologies interact to enable value creation on digital platforms.
Research method	Other research methods such as deductive approaches with secondary dataset could be conducted to verify the findings in this thesis.
Stage of platform development	Future research can explore the interrelatedness of product/service innovations with the evolving ecosystem built on the platforms.

Mid-range theory of affordance perspective	Both affordances and constraints of platforms should be considered to enable comprehensive knowledge of the impact of platforms on value creation.
Unit of analysis	The unit of analysis can be at the ecosystem level rather than the focal firms in this thesis, and the unit of analysis could also be specific platforms, including technical components or boundary resources that are part of the platform (de Reuver *et al*., 2018).
Target cases	For consumer product firms, and other companies such as SMEs, both successes and failures of firms operating digital platforms could also be considered.

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APPENDICES

Appendix A: Semi -structured interview questions (used in Study 1)

1. What is your job title and job responsibility?

2. Can you introduce the company's business, products, or services?

3. Can you describe the company's digital platform? And what are the functions and features of the platform?

4. What is the purpose of creating this platform?

5. How does the platform relate to the company's business and the products or services it provides?

6. What is the company's business process, and what role does the platform play in each step, from receiving orders to completing them?

7. Do customers or partners use the platform? and how do they impact platform development and innovation?

8. What role does the platform play in assessing or understanding customer needs or potential customers?

9. How does the company meet the ever-changing needs of users with new features? And how does it capture unexpected customer needs?

10. What is the impact of the platform on organisational innovation? such as introducing innovative market offerings?

11. What challenges and potential problems have the company encountered while serving customers?

12. What challenges and potential problems have your customers and business partners encountered when they collaborate with the company? And have they reported any problems to your company?

12. How did the company address the aforementioned challenges or problems?

13. Have your firm made improvements to the platform in response to problems that you, your partners, or customers may encounter when using it?

14. Has the development of the platform allowed the company and your partners to offer more extensive or deeper cooperation? (If yes, please give us some examples)

15. Has the aforementioned cooperation brought new opportunities and possibilities for the company's development or innovation?

16. As time passes by, has your company discovered unexpected possibilities or opportunities that the platforms have brought to your company?

17. Have there been any changes to the platform since its inception, and what were the driving factors?

18. What direction will the platform develop in the future alongside the development of new businesses?

Appendix B: Semi -structured interview questions (used in Study 2)

1. What is your job title and job responsibility?

2. Can you introduce the company's business, products, or services?

3. Can you describe the company's digital platform, including the functions and features of the platform?

4. What is the purpose of creating this platform?

5. Do customers or partners use the platform? And how do they impact platform development and innovation?

6. How does the company meet the ever-changing needs of users with new features? And how does it capture unexpected customer needs?

7. How does the platform relate to the company's business and the products or services it provides?

8. What relationship exists between different platforms, such as traditional IT platforms (e.g., ERP, enterprise social media platforms) and digital platforms (e.g., IoT platform, big data platforms)? And how do they interact with each other?

9. Can you describe the role of the company platform in product innovation, service innovation, and process innovation (such as business processes and production processes)?

10. Has the organizational structure or personnel of the company been adjusted to better leverage the value of the digital platform?

11. What organisational capabilities are crucial for developing diverse services? And how can the platforms be potentially used in developing these capabilities?

12. How does the company mine and utilise data and other digital assets to create value?

13. What efforts has the company made to create a platform ecosystem?

14. How does the company utilise resources and capabilities that reside in the platform ecosystem to create greater value and expand the pie?

15. What challenges and potential challenges or problems have the company encountered while serving customers?

16. How did the company address the aforementioned challenges or problems? And can the platform be improved accordingly?

17. As time passes by, has your company discovered unexpected possibilities or opportunities that the platforms have brought to your company?

18. What direction will the platform develop in the future alongside the development of new businesses?