

Title: Exploring Different Dynamic Service Innovation Capabilities in Knowledge Intensive Business Service (KIBS) Firm: the Case of KL-Net

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Summary:

This study investigated different dynamic service innovation capabilities in a knowledge-intensive business service (KIBS) firm. It adopted the demarcation approach. Existing studies of dynamic service innovation capability have not fully reflected what the existing literature on service innovation contributes to our understanding of service innovation modes. Regarding what to change, this study suggest that the four elements of service innovation are service concept, user interface, delivery system and technological options. By using the case of Port-MIS service and KL-Net as a KIBS firm, this study identified different dynamic service innovation capabilities for I-Port-MIS service in KL-Net, according to the newness degree of each element of service and the combination of four elements of service. This accompanied learning about new knowledge of service and technology from stakeholders. The study noted the dynamic service innovation capability of improvement and the formalisation of the service innovation mode.

Keywords: knowledge intensive business service firm, dynamic service innovation capability, service innovation mode, learning, expert knowledge, stakeholders, Port-MIS

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Exploring Different Dynamic Service Innovation Capabilities in a Knowledge Intensive Business Service (KIBS) Firm: The Case of KL-Net

1. Introduction

Studies have highlighted that knowledge-intensive business service (KIBS) firms assume an important role in growing the knowledge-based economy (Miles *et al.*, 1995; Sunbo and Gallouj, 2000). The terminology of KIBS, which was coined by Miles *et al.* (1995), indicates the intensive use of expert knowledge in providing services to client organisations in a business-to-business market (Kim, 2021; Miles *et al.*, 1995; Miles *et al.*, 2019; Miozzo and Grimshaw, 2006). Dynamic service innovation capability is a key activity for the survival and growth of KIBS firms. This paper deals with the dynamic service innovation capability of a KIBS firm. Studies have tried to capture the various features of dynamic capability in organisations with regard to technological and market changes (Ambrosini *et al.*, 2009; Collinson and Wang, 2012; Easterby-Smith *et al.*, 2009; Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003, 2015; Kim and Miles, 2023; Teece *et al.*, 1997; Zollo and Winter, 2002). However, the studies of dynamic capability in KIBS firms are divergent because of the three approaches they take to service innovation (Chen *et al.*, 2015; den Hertog *et al.*, 2010; Janssen *et al.*, 2016, 2018; Sarkar *et al.*, 2016). This study adopted a demarcation approach, arguing that service innovation is different from product innovation, which is in contrast to the assimilation approach (the knowledge of product innovation studies can be used for service innovation) and the integrative approach (service innovation is different, but the knowledge from service innovation studies can be used for the study of product innovation (Janssen *et al.*, 2016). Although the studies of dynamic capability in KIBS firms reflect the achievements of service innovation studies, they have not sufficiently explained the different modes of service innovation such as Gallouj and Weinstein (1997), den Hertog (2000) and Gotsch and Hipp (2012). This implies that the various features of dynamic service innovation capability are not fully captured by the service innovation mode. This limits our theoretical understanding of the relationship between service innovation (mode) and dynamic capability. This study has tried to overcome these limitations.

This article is constructed as follows. The research proposition is developed after the literature review of dynamic service innovation capability, service innovation and the KIBS firm. Based on the research proposition, this study presents the research methodology, data collection and data analyses and presentation. The study used KL-Net as a KIBS firm and examined five dynamic service innovation capabilities identified in the five service innovation tasks of I-Port-MIS (the name of a single window, public service for national port operation) for the Ministry of Oceans and Fisheries and Port Authorities. By analysing the different degrees and properties of learning among dynamic service innovation capabilities in KL-Net, the findings are presented. Lastly, some theoretical implications are presented in the section of conclusions.

2. Literature Review and Research Propositions

Existing studies have highlighted that knowledge-intensive business service (KIBS) firms assume an important role in growing the service-based economy (Miles *et al.*, 1995; Sunbo and Gallouj, 2000). Dynamic service innovation capability is a key activity for the survival and growth of KIBS firms. This section provides the rationale for a demarcation approach to study dynamic service innovation capability in a KIBS firm and suggests the research proposition by reviewing the literature of dynamic capability and service innovation.

2.1. Three Approaches to Dynamic Service Innovation Capability

A group of scholars have paid attention to dynamic capability as the source of a competitive advantage for technological and market changes (Ambrosini *et al.*, 2009; Collinson and Wang, 2012; Easterby-Smith, *et al.*, 2009; Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003; 2015; Kim and Miles, 2023; Teece *et al.*, 1997; Zollo and Winter, 2002). Studies define dynamic capability as the creation of a new capability and the change or reconfiguration of existing capability (Eisenhardt and Martin, 2000; Kim and Miles, 2023; Teece *et al.*, 1997). This definition can be applied here.

Because there are three different approaches to service innovation (Coombs and Miles, 2000; Miles, 2007; Witell *et al.*, 2016), the existing studies of dynamic service innovation capability are divergent (den Hertog *et al.*, 2010; Lütjen *et al.*, 2019; Janssen *et al.*, 2016, 2018). Each approach has created a unique boundary and perspectives on dynamic service innovation capability (den Hertog *et al.*, 2010). The first approach is the assimilation approach (Edvardsson and Olsson, 1996; Edvardsson, 1997). These authors believe that the existing theory of product innovation can be useful and applicable to research on service innovation (Miles, 2007; Miozzo and Soete, 2001; Witell *et al.*, 2016). Their studies have grown from the traditional view, thereby neglecting services. This approach implies that studies of dynamic product innovation capability are utilised to explore dynamic service innovation capability (Kindstrom *et al.*, 2013). The studies of KIBS firms' dynamic service innovation capabilities should not follow the first approach because it is not able to capture the unique dimensions of KIBS firms (Toivonen *et al.*, 2007). In a second approach, some studies have highlighted the differences between service innovation and manufacturing innovation (Gallouj and Savona, 2009; Gallouj and Weinstein, 1997; Snyder *et al.*, 2016; Toivonen *et al.*, 2007). They are grown on the demarcation approach (Miles, 2007; Tether, 2003; Snyder *et al.*, 2016). They have strongly argued that the nature of innovation in services is different from that in manufacturing because of the intangible and interactive aspects, the peculiarities of services and the simultaneous production and consumption of services (Gallouj and Weinstein, 1997; Tether, 2003). The existing studies of dynamic service innovation capability reflect theoretical implications from the demarcation approach (Agarweal and Selen, 2009; Janssen *et al.*, 2016). Some studies of KIBS firms have adopted the demarcation approach of dynamic service innovation capability (Hogan *et al.*, 2011). They are focused on the characteristics of dynamic service innovation capability related to a specific client or ad-hoc event by neglecting the evolution of capability. Finally, the integrative approach to service innovation has been suggested (Miles, 2007; Witell *et al.*, 2016). Authors who adopt this approach argue that the theoretical development of service innovation is applicable to product innovation, although they highlight the unique dimensions of the innovation process in services (Coombs and Miles, 2000; Gallouj and Weinstein, 1997; Toivonen *et al.*, 2007). Den Hertog *et al.* (2010) argued that dynamic service innovation capability should reflect the unique characteristics of service innovation. Their studies captured the features of dynamic service innovation capability in KIBS firms (Janssen *et al.*, 2016, 2018). They came up with an evolutionary mechanism (Janssen *et al.*, 2016). Thus, the second and third approaches can be well suited to KIBS studies. This study takes a position of demarcation approach to study KIBS firms' dynamic service innovation capabilities, because it attempts to reflect the existing studies of service innovation mode, highlighting the differences between manufacturing innovation and service innovation.

2.2. Service Innovation Mode and Dynamic Service Innovation Capability in a KIBS Firm

Studies have tried to understand the dynamic service innovation capability to deal with different learning based on the mode of service innovation (Agarwal and Selen, 2009, 2013; den Hertog *et al.*, 2010; Hogan *et al.*, 2011; Kindstrom, 2013; Jasseen *et al.*, 2016, 2018). Different modes of service innovation have been identified with various parameters (Coombs and Miles, 2000; den Hertog, 2010; Gallouj and Weinstein, 1997; Miozzo and Soete, 2001; Snyder *et al.*, 2016; Tether, 2003; Toivonen *et al.*, 2007). These modes can be classified based on (i) what to change in the construction of service and (ii) the degree of newness of innovation (technology) against a firm and market. The service innovation mode implies various dynamic service innovation capabilities of a firm, which indicates the different degrees of learning in its creation or modification of resources. As Salunke *et al.* (2011) pointed out, studies have sufficiently looked at different dynamic service innovation capabilities within each industry (Janssen *et al.*, 2018; Kiani *et al.*, 2019; Sheehan *et al.*, 2023). Regarding the newness of service innovation, studies have examined different dynamic service innovation capabilities, such as incremental and radical innovation (Agarwal and Selen, 2019, 2013; Sheehan *et al.*, 2023). Sheehan *et al.* (2023) investigated the dynamic service innovation capability of knowledge-intensive business firms regarding radical and incremental innovation. Compared to the continuity of learning in incremental innovation, each firm encountered difficulty with radical learning from existing competencies as this requires that a firm have the ability to manage radical learning. Agarwal and Selen (2013) argued that the effect of incremental and cumulative learning through interactions with stakeholders brings about the evolution of the dynamic capability of service innovation. However, regarding what to change in the construction of service, the studies of dynamic service innovation capability have not reflected the types of contributions they are making (Salunke *et al.*, 2011; Zhan *et al.*, 2021). Gallouj and Weinstein (1997) study constructed service through competence (customer and provider) and technical and service characteristics. They suggested six service innovation modes (de Vries, 2006; Gallouj and Savona, 2009). Tether (2003) argued that Gallouj and Weinstein's study was suitable only for a KIBS study. Den Hertog (2000) suggested the four elements of service innovation are service concept, user interface, delivery system and technological options, which can be applied in the case of KIBS firms. He argued that the change of each element and their combination determine the mode of service innovation. His argument implies that the change of each element and the combination of their elements are used to understand the different dynamic service innovation capabilities in a KIBS firm. Barrett *et al.* (2015) used den Hertog's four elements to understand service innovation through the use of information and communication technology. They implied that their changes can drive the degree of learning in dynamic service innovation capabilities. Milbratz *et al.* (2020) noted that organisational learning varies according to service innovation. Kim and Miles (2023) applied service elements in their dynamic capability study, which contained learning about the service concept and service architecture (user interface and delivery system) in complex product and system service innovation. They identified that a dynamic capability in service is related to the learning of the service architecture, particularly the user interface. These studies can draw an implication that the changes of the four elements or their combination for service innovation can be a determinant of organisational learning in the dynamic service innovation capability of a KIBS firm. Thus, this study considers two indicators of service innovation modes: what to change and the degree of newness of innovation (technology) against a firm and market. Thus, the following research proposition is formulated:

[RP] The degree of each dynamic service innovation capability in a KIBS firm can be different according to the newness degree of each element of service and their combination of four elements of service.

3. Research Design and Methods

3.1. Qualitative and Multiple Case Study

The aim of this study was to investigate the properties and degrees of learning in dynamic service innovation capabilities based on the research proposition. To achieve the purpose of this study, a qualitative and multiple case study was designed. First, the multiple case study design helps researchers generate new scientific knowledge and explore the development of new theories (Tsang, 2014). The replication logic helps produce more generalisable and robust results. As Runfola *et al.* (2017) pointed out, a multiple case study is useful to understand the differences and similarities between multiple cases. This study tried to capture the different degrees of learning among dynamic service innovation capabilities in terms of each service innovation task. Thus, the use of multiple case studies is suitable for this study.

Second, the methodological development of qualitative research opens an opportunity to investigate causal relations or mechanisms (Maxwell, 2004; Sayer, 1992). A qualitative study was adopted due to the advantages of philosophical and methodological developments. The advantage of a qualitative study is to give researchers a useful understanding of what happens in a specific process, what properties and relations are related to specific actors and processes and how they interact with other (Sekaran and Bougie, 2016). This study looks at the different properties and degrees of learning about expert knowledge of service and from stakeholders in each dynamic service innovation capability, which makes the advantages of a qualitative study relevant to this study.

3.2. Data Collection: Case Selection Strategy and Methodology Design

3.2.1. Case Selection Strategy

This section provides an explanation of the case selection strategy and the data collection method. The case selection strategy was to search for a case that was a theoretical fit and to reduce the potential for biased research outcomes from the selected case.

This study selected KL-Net and the 2022 Integrated-Port-MIS advanced project (I-Port-MIS) of the Ministry of Oceans and Fisheries (MOF) and four Port Authorities in South Korea. Port-MIS is the name of a single window, public service information system for port operation (International Maritime Organization [IMO], 2021, p. AP43). I-Port-MIS is owned and served by MOF and four Port Authorities in South Korea. Through a preliminary interview with the chief of a research and development (R&D) team in KL-Net and an initial literature review, it was found that KL-Net conducted seven service innovation tasks in 2022 I-Port-MIS advanced project to improve the I-Port-MIS in MOF and four local Port Authorities. The different level of each task was shown in the 2022 project proposal.

The business of KL-Net belongs to the category of computer services for business (KSIC-J62/63) in the South Korean industrial classification, which is a category of information and communication technology services in the United States and the Europe Union's industrial classification. Based on Miles *et al.*'s (2019) classification, KL-Net is regarded as a technology-based KIBS firm. Thus, they have a good theoretical fit for this study to explore different dynamic service innovation capabilities in a KIBS firm. Additionally, this study can reduce the potential bias of environmental heterogeneity among multiple cases through the case of 2022 I-Port-MIS advanced project. This made it possible to

examine and compare the different dynamic service innovation capabilities within the single project environment.

The study can meet the practical interests of KIBS firms and public organisations that are interested in understanding dynamic service innovation capabilities and Port-MIS. As IMO (2021) stated, public organisations of port management in many countries try to offer Port-MIS as the single window of civil service for ship transfer and cargo carry in/out. Otherwise, many KIBS firms consider dynamic service innovation capability as the key source of competitive advantage. Thus, this study of the dynamic service innovation capability of KL-Net for I-Port-MIS can provide practical information to KIBS firms and public organisations.

3.2.2. Data Collection Method Design

As suggested by Cox and Hassard (2005), a triangulation strategy was considered in designing the data collection method to increase the validity and reliability of this study by collecting the data from various sources and with the use of different methods. The data collection process can be deployed into the desk research stage, field-work stage and complementary stage.

At the desk research stage, the collection of secondary data was conducted from March to June 2023. The sources of secondary data included academic articles, research reports, the request for proposal (RFP) of I-Port-MIS and annual reports and pamphlets of KL-Net. By reviewing this information, researcher(s) became familiar with I-Port-MIS, service innovation tasks and KL-Net. The annual reports of KL-Net from 2014 to 2022, pamphlets and public information from the websites were intensively collected to know the contextual background of KL-Net. This study collected and reviewed the RFPs of I-Port-MIS from year 2014 to 2023 to capture the antecedent and ex-post service innovation capability of I-Port-MIS in KL-Net as well as to identify service innovation tasks and stakeholders in the 2022 I-Port-MIS advanced project.

The interview protocol was developed through the field work on the outputs of desk research. This study developed the items for the questionnaire based on the literature of dynamic service innovation capability and service innovation (see <Table 1>). By using den Hertog (2000), the four components of service innovation were constructed: service concept, user interface, delivery system and technology. The interview focused on the contents and activities of learning the dynamic service innovation capability of each task in the 2022 I-Port-MIS advanced project.

At the field-work stage, the semi-structured and face-to-face interviews were organised from June to August 2023. A snowballing technique was used to identify the interviewees relevant to this study. However, this study triangulated interviewees, for example, an interview with the general director in MOF (client organisation) was triangulated with another interview with the chief of the Port-MIS team (KIBS firm). All interviewees were stakeholders in each task. This study obtained ten interviews with eleven interviewees who were key informants that take the important roles in service innovation tasks in the 2022 I-Port-MIS advanced project. Six interviewees were engineers, team chiefs and executive-level officers in KL-Net. Four interviewees were from MOF, Ulsan Port Authority and the National Information Resource Service. The interview duration was one to almost two hours. The procedure for each interview was replicated through the interview protocol. The interviews took place in the meeting room or reception room of each organisation. All recorded interviews were then transcribed and documented through the Naver Clover Service, which provided the transcription service on voice-recognition machine-learning technology. To assure the transcription quality, each transcription was

double-checked with a researcher. A researcher listened to each interview to check the transcripts and corrected and modified sentences in the transcripts as needed. This is the triangulation technique between artificial intelligence (AI) and a researcher. Some data obtained through the interview was double-checked with secondary data.

-----Insert <Table 1>-----

After the analyses of all data, the complementary review of the analysis was conducted by asking the chief of the Port-MIS team to review the analytical results to prevent researcher bias and produce robust results. The review was conducted in February and June 2024. By triangulating the data collection and analysis throughout all stages, the reliability and validity of this study were enhanced.

3.3. Data Analysis and Presentation

This study investigated the research proposition by applying the template analysis. This technique can exploit the advantages of systematically analysing qualitative data and comparing the analytical results on the template frame (Brook *et al.*, 2015). The coding scheme of template analysis was constructed based on the literature review and research proposition (please see <Table 2>).

-----Insert <Table 2>-----

As Kim and Miles (2023) suggested, the template is framed as the prior capability, learning and ex-post capability to explore each dynamic service innovation capability. This study coded the properties of expert knowledge regarding service (service concept, user interface, delivery system and technology) and the learning from stakeholders. The internal and external learning of existing and new knowledge were coded in terms of service and stakeholders. The coding was manually conducted. However, researchers had experience with template analysis. Because KL-Net conducted five service innovation tasks to advance I-Port-MIS in 2022, the coding of learning was organised on each dynamic service innovation capability. The coding was an iterative process. The results were generated through the repeated works. The results are deployed into the section of results.

4. Results: Five Dynamic Service Innovation Capabilities in KL-Net

This study examined the research proposition. It deploys the results as follows. The first section presents the basic description of KL-Net and I-Port-MIS. Next, an analysis is provided of five dynamic service innovation capabilities in four new dimensions and their combinations as well as an identification of stakeholders in service innovation.

4.1. A Basic Description of the KL-Net Service Business and I-Port-MIS

KL-Net Service Business: The study notices that the competence of KL-Net is specialised in the area of shipping and port logistics. In 1994, KL-Net was established to enhance national competitiveness by reducing the cost of logistics. In 1998, KL-Net developed the first Port-MIS in South Korea; KL-Net had built the competence of a system integration business. KL-Net conducted around 250 projects of service innovation for the Ministry of Oceans and Fisheries, port authorities, carriers, ship agents, many private organisations and others. The development experiences, know-how and skills of service innovation had accumulated. One of the prominent solutions that KL-Net developed for the Ministry of Oceans and Fisheries and local port authorities is I-Port-MIS.

I-Port-MIS: Since Port-MIS was first introduced in 1998, Port-MIS has provided the public service of port operation. Port-MIS is an information system that has computerised all administration tasks related to cargo in/out and the movements of vessels that occur in ports. It realises port administration with application processing using a network connection and electronic data exchange (EDI), Internet and 31 mobile trade ports around South Korea. It is the national-level maritime single window, which offers users the facility of electronic data transmission as well as system software that allows the submission of standardised information to a single entry point. The three regional offices of oceans and fisheries and local port authorities used to have their own Port-MIS. However, from 2014 to 2018, their Port-MISs were consolidated into Integrated Port-MIS (I-Port-MIS). The Ministry of Oceans and Fisheries owned I-Port-MIS and launched its advanced project from 2019 to 2023.

4.2. The Analysis of Five Dynamic Service Innovation Capabilities

This study identified different dynamic service innovation capabilities for I-Port-MIS due to different modes of service innovation. The capabilities were analysed based on the newness degree of four dimensions and their combinations along with their stakeholders (see <Table 3>). They indicate different levels of learning among the dynamic service innovation capabilities.

-----Insert <Table 3>-----

The information strategic planning (ISP) task was non-technical service innovation. Except for the ISP task, the other four tasks were the technical service innovation tasks. Regarding ISP, KL-Net helped the Ministry of Oceans and Fisheries (MOF) to formulate the transformation plan of I-Port-MIS into a cloud-computing-based service. Cloud-computing technology is new to the Port-MIS team and users as MOF and Port Authorities. KL-Net conducted the new learning to develop the new service concept. The learning mainly occurred from MOF, Port Authorities and the National Information Resource Service.

The KL-Net Port-MIS team constructed the data mart of port operations (Data Mart) into the I-Port-MIS system. Data mart is a small data warehouse containing only a portion of the organisation's data for a specific function of users. Data mart and data warehouse technology were relatively new technology for the Port-MIS team, MOF and four Port Authorities. KL-Net organised the learning for the service concept and delivery system.

The enhancement of network security (Network Security) for I-Port-MIS was a medium-level of newness to the Port-MIS team. It followed the National Information Resource Service's JAVA developer guide. The learning was mainly conducted in the area of the delivery system and security technology. Otherwise, the introduction of the I-Port-MIS mobile reporting service (Mobile Reporting) accompanied the learning of the service concept, user interface and delivery system. This service task brought about learning from MOF, Port-Authorities, the Port-MIS operation team in KL-Net and civilians and shipping companies.

Regarding the standardisation of shared data with a local port authority (Data Standard), this task showed a lower level of newness to MOF and the four Port Authorities. The learning was organised in the area of the delivery system.

5. Short Discussions and Conclusions

This paper identified the different combinations of knowledge in five tasks according to service innovation modes, consequently demonstrating five different dynamic service innovation capabilities in a KIBS firm. This study reemphasizes the need for theoretical linkages between dynamic capability and service innovation because the contributions from existing studies of service innovation are not fully reflected in the study of dynamic service innovation capability. Since Miles' (2007) study to classify various types of service innovation, studies have suggested three different approaches to dynamic service innovation capability (den Hertog *et al.*, 2010; Jassen *et al.*, 2016, 2018). This study adopted the demarcation approach (Agarwal and Selen, 2013; Hogan *et al.*, 2011). The empirical evidence in this study showed the unique features of each dynamic service innovation capability identified in the service innovation of a KIBS firm.

This study classified the service innovation modes based on two indicators: (i) what to change using the four elements of service (innovation) construction from de Hertog (2000) and Barrett *et al* (2015); and the degree of newness of innovation (technology) against a firm and market from Gallouj and Weinstein (1997) and Toivonen *et al.* (2007). Compared to other studies of dynamic service innovation capability on newness (Agarwal and Selen, 2013; Sheehan *et al.*, 2023), the service innovation mode of what to change by using the elements of service construction has not been fully examined (Kim and Miles, 2023; Salunke *et al.*, 2011). This study presented five different combinations of the four elements from de Hertog's (2010) construction of service. The five features imply the different modes of dynamic service innovation capability. However, Gallouj and Weinstein (1997) noted six modes of service innovation identified in a KIBS firm. Among them, this study identified the dynamic service innovation capability of improvement and formalisation innovation (e.g., Network Security and Data Standard). Improvement innovation indicates the improvement of certain (technological or service) characteristics without any change to the structure of the system, while formalisation innovation relates to the standardisation or formatted degree of service or technologies (Gallouj and Savona, 2009; Gallouj and Weinstein, 1997). These capabilities have been much ignored in the study of dynamic service innovation capability. This evidence can expand our understanding of dynamic service innovation capability identified in the service innovation mode of a KIBS firm. According to service innovation modes – what to change and the degree of newness of innovation – the evidence identified different degrees of learning about service and from stakeholders between five dynamic service innovation capabilities in a KIBS firm. Thus, this study can give us an important theoretical implication of the pattern of dynamic service innovation capability in a KIBS firm.

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<Table 1> Interview Protocol and Question Items for Interview Data Collection

Section	Questionnaire Items	Activities
Introduction	- Thanks given to interviewees - Project and interview purpose - Interview procedures - Interviewee's role in service innovation task	Obtained permission for voice recording.
Scope of interview	- Service innovation tasks conducted in 2022 - Stakeholders	Cross-checked a list of service innovation tasks from 2022 RFPs.
Antecedent service innovation capability	- Existing service innovation capability of I-Port-MIS - Service concept, user interface, delivery system and technology	- Cross-checked with the data obtained from RFPs or other sources. - Triangulated the content from other interviews.
Knowledge properties and learning	- Each service innovation task - Contents and activities of learning: service concept, user interface, delivery system, technology and stakeholders	- Cross-checked with the data obtained from RFPs and other sources. - Triangulated the content from other interviews.
Ex-post capability and request	- Outputs of dynamic service innovation capability - If possible, viewing the internal documents or pictures, such as I-Port-MIS concept, workflow and project reports	Cross-checked with the data obtained from interviews.
Close	- Ask to recommend an interviewee - Closing remarks*	Wire transfer of advisory fee.

Source: author's elaboration.

<Table 2> The Coding Scheme of Template Analysis

Section	Coding	References
Antecedent capability	• Antecedent degree of knowledge: – Knowledge: service concept, user interface, delivery system and technology – Knowledge: stakeholders	• Toivonene <i>et al.</i> (2017) • den Hertog (2000)
Knowledge properties and learning	• The service innovation tasks and their newness • Learning about service concept, user interface and delivery system and technology – Existing and new knowledge • Learning from stakeholders – Existing and new knowledge	• den Hertog (2000) • Jassen <i>et al.</i> (2016, 2018) • Project RFPs
Ex-post capability	• Ex-post degree of knowledge – Knowledge: Service concept, customer interface, delivery system and technology – Knowledge: stakeholders	• Toivonene <i>et al.</i> (2017) • den Hertog (2000)

Source: author's elaboration.

<Table 3> Five Dynamic Service Innovation Capabilities: Newness and Stakeholders

Task Level (Newness)	Service Innovation Task (Abbreviation)	Newness				Main Stakeholders
		Service Concept	User Interface	Delivery System	Key technology	
High	Information strategic planning: Transforming Port-MIS into cloud computing (ISP)	Yes	No	No	(New) (1) Cloud-computing, (2) Telecom equipment, (Existing) (1) Architectural technology of I-Port-MIS	- Ministry of Oceans and Fisheries (MOF) - Port Authorities - National Information Resource Service
High	Data-mart construction for I-Port-MIS (Data Mart)	Yes	No	Yes	(New) (1) Data warehouse (2) Data mart	- MOF - Port Authorities - National Information Resource Service - Port-MIS operation team in KL-Net
Medium	Enhancing network security of data sending and receiving between internal and external networks in I-Port-MIS (Network Security)	No	No	Yes	(New) (1) The technical method to secure data sending and receiving	
Medium ~ Low	Introduction of I-Port-MIS mobile reporting service (Mobile Reporting)	Yes	Yes	Yes	(Existing) (1) Responsive Web in Mobile Service	- MOF - Port Authorities - Port-MIS operation team in KL-Net - Other relevant users (civilians)
Low	Standardisation of shared data with a local port authority (Data Standard)	No	No	Yes	(Existing) (1) Data standard	- MOF - Ulsan PA - Port-MIS operation team in KL-Net

Source: author's elaboration on the project proposal and interviews. The Port-MIS team in KL-Net confirmed the result.