Algemene logistiek

Towards an integrated scan for technological and non-technological aspects of digitalization

In today's economy digitalization is a necessary condition for SMEs.

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Abstract

In today's economy digitalization is a necessary condition for SMEs. Following recent developments, such as the emergence of industry 4.0 and Data Driven Logistics, SMEs gained great potential to enhance their business models. They are forced to do so, as major companies, such as Amazon and Unilever, have increased their competitive advantage by adopting technological development while SMEs are lagging behind. Most of the companies in the Netherlands are SMEs, which lack this capacity and capabilities, so it is important for the Dutch economy that they keep pace with the technological developments. However, the success of digitalization depends on effective technological and non-technological enablers. Furthermore, in order to successfully digitalize, SMEs need to invest both in systems and skills which is a major challenge for them. SMEs need to span their institutional boundaries in order to be able to identify, acquire and exploit relevant knowledge for their organization, as the availability of technological knowledge often is insufficient. Consequently, it is better to offer SMEs plug and play solutions as the implementation period is shorter. At the same time, it is necessary to increase their knowledge absorption capacity, as technological knowledge is growing at an increasing speed and digitalization is a never-ending process. This paper explains the first steps of developing an integrated maturity scan and road map for the technological and non-technological aspects of digitalization, based on the relevant aspects of previously performed comprehensive literature studies. The paper answers a part of the central research question of the SIA RAAK MKB project proposal that has been submitted by the authors, entitled *Digitalization at SMEs: Plug & Play Readiness, "How to develop an integrated maturity scan and a road map that includes technological and non-technological enablers of digitalization to help SMEs define and perform the next steps in digitalization in order to enhance their business model?"* The contribution of the paper is that it proposes the first steps towards an integrated approach, which has been lacking from the literature up till now.

Introduction

Digitalization is a necessary condition for SMEs to participate in an increasingly digitalized economy. Following recent technological developments, such as the emergence of industry 4.0 and Data Driven Logistics, SMEs have gained a great potential to enhance their business models. Major companies, such as Unilever and Amazon, have done so already, as they have higher maturity level and capacities and capabilities to identify, transfer, transform and exploit new knowledge. However numerous SMEs lag behind as lack these capacities and capabilities. In order to improve their situation, companies should have technological and non-technological enablers and make use of them.

On the technological side, there is definitively a gap to close. From the Dutch 100 top logistics companies, only 20% is seriously involved in digitalization and 5% uses digitalization to its full potential. In general, the smaller the company, the less likely it is to digitalize (Moonen, 2021). The companies themselves are quite optimistic about their rate of digitalization, the Dutch trading and production companies give themselves a score of 6,9 out of 10. This is misleading, as some companies consider sending invoices as PDF a major step in digitalization, while it is still a part is a manual process. Most of the companies still use Excel as a planning tool, only about 20% of them have more than a basic system, such as road planning (TMS) and warehouse management systems (WMS) and 60% of the companies still type data over from one system to another. Three of the five companies indicate that their internal systems are not connected. The major reason for this is the lack of knowledge. Digitalization is not only about buying a new system but applying it in a smart safe and responsible way (Logistiek.nl, 2021). At the end it all comes down to the lack of manpower and knowledge in the companies (evofenedex 2021).

Non-technological enablers are in line with Johnsson (2017) as collaboration, culture, education, knowledge, management, strategy and structure. Here strategy, management, knowledge, collaboration and structure will be treated as education and culture are a logical result of these categories. Rapid technological developments enhance the importance of these enablers, as they have a major impact on the existing knowledge base for organizations (KIA, 2019; Eisenhardt & Tabrizi, 1995). Consequently, most of these organizations and their employees are confronted with high novelty problems that cannot be solved with existing knowledge. This challenge creates boundaries for the production of new knowledge which places a burden on existing processes, procedures and users (Nonaka & von Krogh, 2009). Absorbing external knowledge, by spanning the boundaries of the organization, is key for the organization to innovate (Phene, Fladmoe-Lindquist, & Marsh, 2006). Within this context knowledge management, defined as the process of capturing, distributing, and effectively using knowledge, is a crucial factor (Davenport, 1994). An organization's absorptive capacity, to identify, transfer and transform new knowledge, is influenced by an organization's system for spanning processes (Chesbrough, 2003).

Spanning involves, among other things, using employees to interact with other organizations and or actors to extract vital knowledge for their own organization (Fichter & Beucker, 2012; Haas, 2015). However, it proves in general to be difficult for small SMEs to organize these processes (Veenendaal, 2015; Im & Rai, 2008). In practical terms it entails exchanging exploitation capacity from employees for exploration capacity (Dahlander, O'Mahony, & Gann, 2016). Often, external exploration requires a 'distributed approach'. This means in order to reduce the risk of not finding redundant information, this takes even more capacity (Leiponen & Helfat, 2011). Furthermore, identifying relevant knowledge and transferring it to the organization asks for special skills (Carlisle, 2002) and a systematic approach to transform this knowledge for exploitation (Cvitanovic, McDonald, & Hobday, 2016).

Therefore, this paper proposes an integrated approach between technological and non-technological aspects of digitalization as this lacks in the academic literature. The current disadvantageous position of SMEs requires swift action, both in terms of technological knowledge and innovation acceptance. Better than concepts, companies should be offered plug and play solutions, which are easier and faster to implement. However, the companies should be ready for them. In order to help SMEs with their challenges with digitalization, the authors have submitted a SIA-RAAK MKB research proposal, entitled: *Digitalization at SMEs: Plug & Play Readiness*. The aim of this project is to develop and make available a practical maturity scan together with a road map to identify and perform the next steps in digitalization. The scan and roadmap offer differentiated steps and solutions applicable for different types of SMEs. At the same time, the project helps SMEs to acquire and transform relevant information, by knowledge cocreation. The project includes case studies at 40 companies, and an extensive literature study both on the technological and non-technological enablers of digitalization. The project is led by the RUAS and is performed in cooperation with SMEs, some large companies, the Rotterdam Port Authority, evofenedex, Poort8 and TNO.

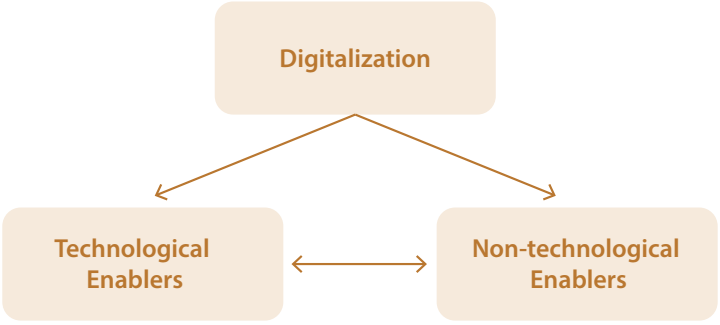

Figure 1 The enablers of digitalization

This paper builds forth on a previously conducted literature studies (Paardenkooper, 2022; Wiersma, 2021). On the topic of the technological enablers of digitalization the following research gap is identified: in the academic literature there is a lot of attention for digitalization, however the relationship between technological digitalization requirements and necessary knowledge management conditions for absorbing this new digital technology lacks. This is the major research gap to be filled by our research. The contribution of this paper is therefore the description of how an integrated scan that takes into account both aspects can be created. The literature study on the non-technological enablers of digitalization has revealed that the academic literature lacks research on the relationship between different knowledge boundaries of individuals and organizations and the capacities and capabilities to absorb knowledge on different levels. This difference can be categorize in maturity tiers. By constructing a maturity scan and roadmap this research gap is also going to be filled. In the paper a part of the central research question of the proposal is answered:

"How to develop an integrated maturity scan and a road map that includes technological and non-technological enablers of digitalization to help SMEs define and perform the next steps in digitalization in order to enhance their business model?"

In this paper we present the theoretical basis and the steps of composing the integrated maturity scan and roadmap for the technological and non-technological enablers of digitalization. The contribution of the paper is to show the necessity of an integrated approach towards digitalization. In section 2 the approach is explained, followed by identifying and explaining the most important elements for the maturity scan and roadmap from the literature based on a previous comprehensive literature study in section 3. Section 4 elaborates on how the maturity scan will be constructed on both kinds of enablers. The paper ends with a conclusion.

Enablers

This section explains the most important topics about the technological and non-technological enablers of digitalization, based on academic and grey literature. For the technological aspects these are: maturity levels and their connection met an enhanced business model, a blockchain feasibility scan, that can be adjusted to be used for more general purposes, the Digiscan of evofenedex and the decision tree Platform Datagids. For the non-technological aspects these are: knowledge and its types, knowledge management, knowledge absorption capacity, knowledge boundaries and boundary spanning.

Measuring Technological Enablers

Technological enablers facilitate the production, sharing and management of digital products and processes within organizations and with peers and stakeholders. These enablers can be categorized in four groups: Big Data, Cloud Computing, Mobile Connectivity and Social Media (Moreira, Ferreira, & Serca, 2018).These technological enablers aim to create an organisational networked environment that connects processes, products and people. When effectively done the role of humans is reduced in these processes in order to save costs. Furthermore, these inter linkages create possibilities for a more sustainable organization (Kiel, Müller, Arnold, & Voigt, 2017).

Maturity levels and an enhanced business model

The academic literature contains mostly analysis of the application of digitalization in particular cases. There are two exceptions found. Firstly, Heilig et al. (2017) define five maturity levels on which digitalization takes place, localized exploitation, internal integration, business process redesign, inter organizational redesign and business scope redefinition. The first three levels relate to the changes within the company, while the fourth and fifth levels refer to supply chain level. At the last, fifth level the revision of the business model and strategy takes place, such as restructuring or outsourcing the activities, including new products and services and change long standing alliances and practices. Secondly, Verhoef et al. (2021) who describes the process of digitalization in three steps, external drivers, phases and strategic imperatives of digitalization. Within the phases of digitalization, they distinguish three levels, digitization, digitalization and digital transformation. Heilig et al. (2017) and Verhoef et al. (2021) agree that digitalization eventually leads to a new, enhanced business model. However, their work remains on the descriptive level. What is missing in the academic literature is advice for companies on how to proceed with digitalization, namely maturity scans and road maps. However, the gray literature is more helpful.

Blockchain feasibility scan

From the academic literature review it became clear that digitalization needs to be connected to the business model/ strategy. In the gray literature Heeroma et al. (2020) developed a business scan for the applicability of blockchain to logistic SMEs. They examine the added value of the company from a strategic point of view, followed by exploring the power relations in the supply chain and the critical processes of the company. Lastly, they analyze the critical processes further, in order to assess the applicability of blockchain technology. They have selected from the academic literature research methods and tools on strategic, tactical and operational level and combined them. The proposed tools and methods are the SWOT analysis together with a confrontation matrix, SCOR metrics, Business Process Notation (BPMN or swimming lane analysis), RACI or RASCI that explores the responsibilities of employees in the processes within the organization, and finally the

Olson criteria are used for the assessment of information quality. This scan was originally intended for research on the application of blockchain, nevertheless it is also useful for a problem driven approach to digitalization and data driven logistics. However, it is necessary to include a scan that is specifically meant for digital maturity, which is discussed in the next section.

Digiscan of evofenedex

Digiscan of evofenedex also belongs to the grey literature. Evofenedex is the Dutch association of 15,000 production and trading companies. In order to help its members to digitalize, Evofenedex has developed a digital maturity scan (Evofenedex, 2021). For the scan companies need to answer 260 questions on 18 topics. The topics of the Digiscan include, next to the technoligical elements that are discussed above, company culture, customer value, budget and (human resources) strategy and more. Based on the results the scan calculates on which digital maturity level a company is situated. There are four maturity levels described which are; digital core, connectivity, technologies and disruption. Within the Digital core level, companies are structuring their business in order to collect reliable and relevant data. In the connectivity level they retrieve from and share data with supply chain partners. In the technologies phase they implement techniques in order to analyze the data and in phase 4 they use the outcomes of phase 3 in order to change their business model. The levels are comparable to the levels of Heilig et al. (2017) although de Digiscan has one level less. An overview of the levels of the mentioned scans can be found at Table 1The goal of the Digiscan is to give advice to companies about what the next steps are for them in digitalization based on their digital maturity level. For example, for a company that is on level one, the digital core, some steps should be taken before it can start initiating a blockchain implementation. Next to Digiscan, there is another tool that can advise companies about their advancement in digitalization based on a decision tree, which is introduced in the next paragraph.

Table 1 Overview of the maturity levels of the mentioned maturity scans

	Heilig et al. (2017)	evofenedex (2021)	Verhoef et al. (2021)
Level 1	Localised exploitation	Digital core	Digitization
Level 2	Internal exploitation	Connectivity	Digitalization
Level 3	Business process redesign	Technology	Digital transformation
Level 4	Inter organizational redesign	Disruption	
Level 5	Revision of business model		

Platform Datagids

Platform Datagids of Poort8 is also classified as grey literature, as there are no academic articles published about it yet. Poort8 is a consultancy company which specializes in solutions for federative data sharing (Poort8, 2021). It has developped Datagids, a platform for companies looking for the next step in digitalization. Companies need to fill in a decision tree which starts from their motivation, goals and the obstacles that they experience in digitalization in order to guide them to the solution. Based on the answers the company is provided with the data of the parties that can provide a solution to the company's problem. Basically, it is a matching platform for problems and solutions and the parties that can help. For this research it is a relevant tool as it contains solutions that are accumulated by years of research.

Measuring Non-Technological enablers

Among non-technological enablers for digitalization such as leadership, organizational culture, people, strategies (Bose, 2004), knowledge management (KM) is regarded as one of the most influential enablers since knowledge management structures knowledge both vertically and horizontally within an organization and beyond its boundaries (Ichijo, Krough, & Nonaka, 1998; Lee & Hong, 2002). Knowledge Management is part of Human resources management, since a lot of knowledge is held within individuals and needs to be transferred between different employees.

Knowledge and its types

Knowledge is crucial for both societies and organizations to realize transformations i.e., digitalization. Most innovation in SME's is based on exploitation innovation. Exploitation innovation means adaptive changes in the daily practices and is generated by a specific type of knowledge management. Traditionally knowledge can be divided into tacit and explicit knowledge (Polanyi, 1967; Collins H, 2010). Tacit knowledge is informal personal knowledge, related to a specific context or work environment. Explicit knowledge is most of all formal, registered in writing, for example procedures and protocols. Extraction or sharing of knowledge between different stakeholders therefore highly depends on the alignment of these different knowledge modes (Hartmann, 2008). Effective exploitation and commercialization of knowledge takes place when organizations create or produce knowledge by themselves or reform knowledge concepts. Most knowledge production in innovation is tacit knowledge, which increases the speed of innovation and reduces again these high costs of R&D when a more pragmatic type of research in collaboration is used (Nowotny, Scott, & Gibbons, 2003; Chesbrough, 2003). This also means that in these contexts most innovation comes from recombining of tacit knowledge (König, Battiston, Napoletano, & Schweitzer, 2011). However, tacit knowledge is more often contextual. This means that it implies to a certain situation or specific work process. This makes it more

difficult to transfer this knowledge from one place to another. Sharing explicit knowledge is easier, since it can be done through texts, but it is more difficult to adapt this kind of knowledge to procedures in a specific context (Collins H., 2010).

Another classification of knowledge is conceptual and procedural. Innovation highly depends on organizational learning. Conceptual knowledge is static and descriptive in its nature. It gives or describes information on why things work in a specific manner and is therefore more declarative (know-why). This type of knowledge is helpful for deep understanding of concepts. It is contrary to procedural knowledge which explains how things work, used in procedures or protocols. As a result, conceptual knowledge is more often explicit and procedural knowledge more implicit (know-how) (Kump, Moskaliuk, Cress, & Kimmerle, 2015). An important condition is what knowledge can be internalised, both in procedures, as well as in employees (Nonaka & von Krogh, 2009).

Knowledge Management

Knowledge management is called the modus operandi for a learning organization (Weggeman M., 1996). Knowledge management in this sense can be described as a learning process through exploration and exploitation using both systems and human resources to enhance the organization's performance and intellectual capital (Jashapara, 2004). This means that learning and learning processes are concerned with how knowledge is being generated. Knowledge management facilitates collaborative learning, shared understanding of key concepts, and co-evolution toward common purpose, intent, and action (Roux, Rogers, Biggs, Ashton, & Sergeant, 2006; Jennings, 2005). Therefore, managing knowledge is an important process that supports and facilitates the exploitation of new knowledge to create more innovative capacity (Zahra & George, 2002; Connelly & Kelloway, 2001; ATW, 2014). When the conversion of new ideas, concepts are formalized in procedures or in explicit knowledge, an organization has successfully absorbed new knowledge (Etzkowitz, H, & Ranga, 2013). Therefore, an important factor in of knowledge management is the creation of knowledge absorption capacity.

Knowledge Absorption Capacity

Knowledge absorption capacity is organizations' ability to value, assimilate and apply new knowledge for improving organizational learning (Cohen W & Levinthal, 1990). The absorptive capacity of a company is influenced by a number of interrelated factors. Cultural dimensions of the organizational affect the willingness and ability to share and identify critical knowledge. Characteristics of key actors, such as skills, education, experience explains the level of identification and recognition in from external knowledgebases. The ability to use prior knowledge and the ability and or capacity to learn as an organization are also important factors in the absorption process (Nooteboom, Vanhaverbeke, & Duysters, 2005; Chesbrough, 2003; Weggeman M., 2000).

How this effects recognition of knowledgebases between stakeholders, can be explained by epistemological dimensions in terms of beliefs, values and goals explains Absorbing external knowledge, realized by spanning the boundaries of the organization, is therefore key for the organization in order to innovate (Phene, Fladmoe-Lindquist, & Marsh, 2006). An organization's absorptive capacity is divided into three processes: identification, transfer and transformation to eventually be able to exploit new knowledge. is influenced by an organizations' boundary permeability (Levina & Vaast, 2004; Edmondson & Harvey, 2017) Figure 2 shows the relation between maturity and expoitation of critical knowledge.

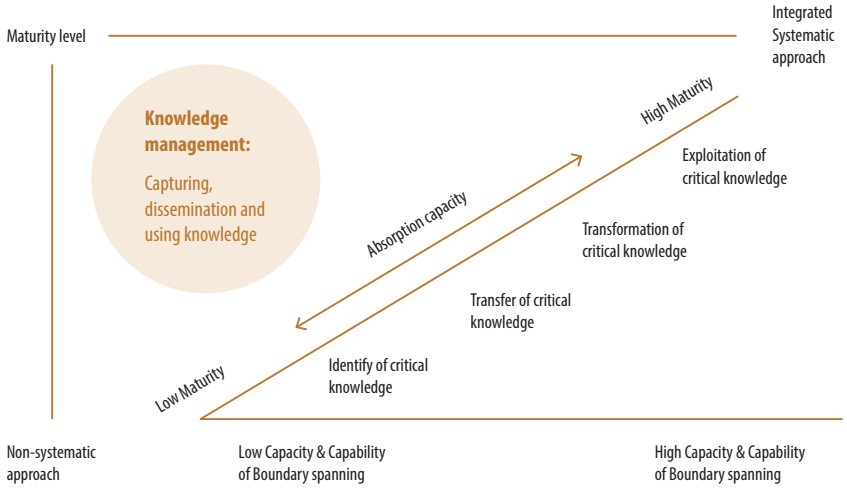

Figure 2 Relation between maturity and exploitation of critical knowledge (own creation)

Knowledge Boundaries and Boundary Spanning

Boundaries are often mentioned notion in the Human resources literature. Knowledge is often ''held '' within defined boundaries of organisations or communities. Employees work and think through their own frame of reference for sense making (Riege, 2005; Etzkowitz & Leydesdorff, 2000). Especially knowledge boundaries of an organisation affect the absorption of critical knowledge. Knowledge boundaries are concerned with exchange or transfer of knowledge between disciplines, organizations and actors (Carlisle, 2002) There are different categories of knowledge boundaries: individual, domain-specific, spatial, temporal and task oriented (Tell, Berggren, Brusoni, & Van de Ven, 2017). The rapid advent of innovations also influences the boundaries between industries. Organizations can benefit from these rapid changes by adding value from incorporating knowledge that comes free

through this boundary dissolvement or permeability. Exceeding these boundaries affect the absorption of critical knowledge regarding the organizations' system- and human resource capacities and capabilities. Knowledge boundaries can also act as conjunctures for learning for between knowledge institutes and SMEs.

Boundary spanning is understood as a combination of interrelated activities concerned with connecting different actors from the realm of government, society, and business, building sustainable relationships and information transfer between these actors (Meerkerk & Edelenbos, 2014). Key actors can act as 'boundary spanners', in reducing the proximity and seizing new knowledge (Haas, 2015; Howell, 2005). Boundary spanners can cross boundaries and engage stakeholders, negotiate power dynamics, communicate expectations, and build connections by creating boundary objects (Fariar, 2010; Molina-Azorin, 2014). Identifying critical knowledge for the organization and transferring it to the right place asks for special skills (Carlisle, 2002) and require a systematic approach from the organizations to transform this knowledge for exploitation (Cvitanovic, McDonald, & Hobday, 2016). Furthermore, integration of knowledge in an organizations' knowledge base demands a distributed HR approach. This approach aims to reduce the risk of not finding redundant information, this takes capacity (Leiponen & Helfat, 2011). This distributed approach minimizes the risk of wasting time and money for a SME, by minimizing the transfer from exploitation to exploration. This is a conditional requirement to add value by the newly transferred knowledge (Valverde, Ryan, & Soler, 2006). Organizations can reduce risks of not absorbing the right knowledge by managing is absorption by boundary spanning processes.

Maturity scan and roadmap

In this section we explain how the two parts of the maturity scan are constructed and integrated. For addressing the technological enablers, we propose a synthesis of the scan of Heeroma et al. (2020), Digiscan and Datagids. The scan of Heeroma et al. (2020) is adjusted and used in this case for a more general purpose, than it was originally meant for. This scan will deliver the connection between the company's strategy and the possible added value of digitalization, and the practical use of digitalization in its critical processes. The next step is to perform the Digiscan, to establish the digital maturity level of the company. From the digital maturity level, it can be derived what the next steps are that the company can take to digitalize more and strive towards data driven logistics. The solutions can be sought for in the decision tree of Datagids. This step validates the database and eventually found solutions can enrich it further, thus improving this tool to help SMEs to digitalize. Up till now the research has a linear flow, parting from a digital strategy towards data driven methods. However, as the outcome of digitalization changes the business model and that the technological development is endless, the model of the research is supposed to be circular.

Non-Technological Enablers

The scan for the non-technological enablers makes representations of different types of knowledge boundaries (syntactic semantic and pragmatic). Representations means a categorisation and description of types of boundaries that organizations are confronted with. By using the scan an 'image 'is made of the organizations knowledge system maturity as well as HR maturity HR maturity is measured in dynamic capabilities for exploitation and exploration. Based on the scan and Big Five test we can identify 4 types of Boundary Organizations and employ a distributed approach making a road map for SMEs for increasing the absorption capacity of critical knowledge. This approach defines both systems and human resources needed in terms of capability and value exchange. Figure 3 shows the 4 types of innovation spaces on which the to be developed road map is based.

By developing this scan, we can reduce risks in terms avoiding costs for exploration and exploitation exchange (innovation efficiency). Firstly, the scan is used to identify knowledge needs based on non- technological maturity levels of the organization. We can determine the type of knowledge that is required for the organizations' innovation purposes. With the scan we can determine the available knowledge on a specific subject or process (knowledge stock) and secondly the scan can determine the activities such as available system of knowledge management, learning experiences and available dynamic capabilities in terms of human resources. By identifying the knowledge boundaries, we can lay out the instruments for exceeding specific boundaries in order to successfully transfer and transform so it can be exploited. With the help of the Big five theory, we can add the specific cultural element of the organization for rigor of the scan. This helps to look at the behaviour of employees next to organizational characteristics (Dan, et al., 2021). By designing and implementing a HR distributive approach we can create a path for effective and differentiated absorption activities on based on the SMEs maturity level.

Table 2 The four types of Innovation spaces (Own creation)

Type A	Type D
In this position organisations boundary spanning takes place through experts. These actors span boundaries by doing research, connecting science and policy (Cvitanovic, McDonald, & Hobday, 2016). Spanners in this position have enough resources and facilities. However, spanning capacity impact might be low because actors face pragmatic boundaries (Carlile, 2002; Wilhelm & Dolfsma, 2018). The capacity of spanners is influenced by long term and complex processes in order to contribute to sustainable solutions (Cohen, 2018). Skills in this position deal more with negotiating scientific knowledge (Cvitanovic, McDonald, & Hobday, 2016).	In this position spanners have a common interest, and a common semantic repository to act on. It can be described as a position or context in which there is a specific (design) language (Dell'Era, Marchesi, & Verganti, 2010). Transfer and translations take place by elaborating these semantic repositories into new applications with the aid of spanners in boundary positions. Customers may play an important role in new product or process design; therefore knowledge needs to be interpreted more often. But at the same time there are also syntactic barriers since designers have a more specific logic and or norms in practices (Stompff & Smulders, 2013).
Type B	**Type C**
For organisations in this position the need knowledge is highly practical. Knowledge is situated and more tacit than explicit. The main task for boundary spanners is finding solutions. Political drives create semantic boundaries in specific networks (Jennings, 2005; Valente & Marchetti, 2015). Boundary objects in this position influence the user's tasks and the cognitive usefulness'. Knowledge is a tangible asset in such way that is consists of very 'concrete' objects with detailed or clear information (Fong & Srinivasan, 2007; Oldenburg, 2019).	In this position the context is based on the idea that collective or communal knowledge of boundary spanners play an important part in the innovation process (Griffith, 2003; Hafkesbrink, Evers, 2010). Knowledge is here more often tacit (Gluch, Johansson, & Räisänen, 2013), experience plays an important role (Wenger, 1998) as with engagement (Tushman, Smith, Wood, Westerman, & O'Reilly, 2002; Tushman, 1977). Trust is also often stronger in closed communities and knowledge is enclosed in practises (Lam, 2014). Objects in this position play a part in a common task (Fox, 2011) and for a sustainable network (Meerkerk & Edelenbos, 2014; Gee, 2005).

After the two scans and roadmaps are developed, they will have to be integrated. This will be a challenge as the scan and roadmap for the technological enablers is a synthesis of existing scans, while the scan and roadmap for the non-technological enablers is developed from scratch. This is one of the goals of the project and it will be done after an extensive qualitative and quantitative literature review and case studies in 40 (SME) companies.

Conclusion

In this paper we have presented the theoretical basis and the steps of creating an integrated maturity scan and roadmap for both the technological and the non-technological enablers of digitalization for SMEs to identify and perform the next steps in digitalization. We have identified two research gaps in the previously performed comprehensive literature reviews: the lack of scans for both types of enablers and lack research on the relationship between different knowledge boundaries of individuals and organizations and the capacities and capabilities to absorb knowledge on different levels. This research contributes to filling both gaps.

The most important elements for creating an integrated scan are identified; for the technological enablers these are maturity levels and an enhanced business model from the academic literature and, a blockchain feasibility scan, the Digiscan of evofenedex and platform Datagids from the grey literature. The scan and roadmap for the technological enablers of digitalization is constructed by synthetising an adjusted blockchain feasibility scan, the Digiscan of evofenedex and the decision tree of Datagids. A peculiarity of the scan and roadmap is that it starts with a digital strategy, which leads to digitalization, which on its term results in a new business model, which requires an new strategy. This means that there is a circular model. For the non-technological enablers the important elements are: knowledge and its types, knowledge management, knowledge absorption capacity, and knowledge boundaries and boundary spanning.

The scan and road map for the non-technological enablers of digitalization will be an innovation scan for knowledge management maturity tiers, that will be tested on four dimensions, dynamic capabilities, knowledge conversion, organizational characteristics and boundary spanning. Boundary objects and different knowledge boundaries will be described in terms necessary requirements and enablers for each phase of the absorption proces of critical knowledge. Based on the score on the four dimensions, and the knowledge boundaries an advice will be given on the implementation of a type of knowledge management interface and corresponding instruments. By integrating these concepts it will be possible to determine a differentiated set of instruments for different SMEs to enhance capacities and capabilities. Integrating the two scans is a challenge as one of them is synthetised from existing tools and the other is created from scratch .This has to do with the novelty of the approach. The integration is one of the main goals of the project and it will be persued in the SIA RAAK MKB project *Digitalization at SMEs: Plug & Play Readiness*, if the funds are allocated.

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