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ORGANIZATIONAL CAPABILITIES OF COMPANIES REQUIRED FOR REALIZATION OF IOT PROJECTS

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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

Я, Никулин Евгений Игоревич, студент второго курса магистратуры направления «Менеджмент», заявляю, что в моей магистерской диссертации на тему «Организационные способности компаний, требуемые для внедрения IoT проектов», представленной в службу обеспечения программ магистратуры для последующей передачи в государственную аттестационную комиссию для публичной защиты, не содержится элементов плагиата.

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АННОТАЦИЯ

Автор	Никулин Евгений Игоревич
Название ВКР	Организационные способности компаний, требуемые для внедрения IoT проектов
Направление подготовки	Менеджмент
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Описание цели, задач и основных результатов	Целью данной работы является определение организационных способностей компаний, требуемых для реализации IoT проектов. Задачами данной работы являются: - анализ организационных способностей компаний, требуемых для реализации IoT проектов - выявление ресурсов компаний, требуемых для реализации IoT проектов - выявление организационных рутин, требуемых для реализации IoT проектов В ходе обзора литературы, изучения кейса компании GO+, а также экспертного интервью были определены необходимые организационные способности, ресурсы и рутины, требуемые для реализации IoT проектов. Таким образом, основным результатом работы является сформированная теория (модель), включающая в себя необходимые организационные способности, ресурсы и рутины для реализации IoT проектов.
Ключевые слова	Интернет Вещей, проекты в области Интернета Вещей, организационные способности, организационные ресурсы, организационные рутины, операционные способности, динамические способности

ABSTRACT

Master Student’s Name	Nikulin Evgenii
Master Thesis Title	Organizational capabilities of companies required for the realization of IoT projects
Main field of study	Management
Year	2020
Academic Advisor’s Name	Olga R. Verhovskaya Associate Professor, Department of Strategic and International Management

Description of the goal, tasks and main results	The aim of this study is to explore the organizational capabilities required for realization of IoT projects. The tasks of this study include: - Analysis of organizational capabilities of companies that implemented IoT - Discovery of resources for organizational capabilities creation and development that are necessary for realization of IoT projects - Discovery of routines supporting creation of organizational capabilities that are crucial for realization of IoT projects Based on the literature review, case study of GO+ company and the expert interview, required organizational capabilities, resources and routines for realization of IoT projects were explored. Thus, the main result of this study is a developed theory (model) consisting organizational capabilities, resources and routines required for realization of IoT projects.
Keywords	Internet of Things, IoT projects, organizational capabilities, organizational resources, organizational routines, ordinary (operational) capabilities, dynamic capabilities

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Introduction

The 21st century has brought many changes to the human lives. Although it doesn't feel that 2000 was that long ago, during the last 20 years the world has seen the rise of Apple, the global financial crisis, which was the worst since the Great Depression, electric car in the space and many more events that already became iconic for this century. However, one of the most iconic events that reshaped our world was the advance of the Internet.

At the time when the Dot-Com bubble burst, the number of internet users was about 304 millions. In June 2019 it exceeded 4,5 billion. Being one of the most transformative and fast-growing technologies, Internet has led not only to the major changes in how people communicate but also to the way how business operates. It stimulated the appearance and promotion of new concepts such as e-business and e-commerce, re-engineered business processes and profounded structural changes in the production of goods and services (Apăvăloaie, 2014). The Internet has matured and was adopted by the vast majority, however, it is reshaping our world again, connecting not only people but also things.

The term Internet of Things (IoT) was first mentioned by Kevin Ashton in 1999 and the concept still seems odd. Unlike the Internet, IoT is currently in the Early Adopters stage of the Technology Adoption Life Cycle model (Cyzerg, 2018). At the same time, the interest in the technology from enterprises is tremendous since it promises tantalizing opportunities for product innovation and creates attractive business opportunities in a wide range of industries. According to DBS bank, the installed base of IoT-connected devices will soar from about 11 billion today to 125 billion in 2030 (DBS Group, 2018). Moreover, it is expected that IoT will be the key element in stimulating other technologies such as Artificial Intelligence (AI), which enables machines to simulate intelligent behavior and make well-informed decisions with little or no human intervention. Nevertheless, most of IoT projects are unsuccessful. According to a survey, conducted by Cisco, the failure rate of IoT projects is 75% (Cisco, 2017). The companies who want to utilize IoT mentioned that the biggest challenges are complexity and technical challenges (38%), lack of knowledge (29%) and difficulty finding the right solution (28%) (Microsoft, 2019). Besides, Microsoft's research shows that around one-third of IoT projects fail in proof of concept stage due to the numerous reasons which include absence of clear strategy, lack of resources/knowledge to scale and unclear business value that pilots demonstrate. Despite the aforementioned challenges, companies continue their attempts in identifying the IoT services and solutions that can be monetized, making particular attention to IoT platforms which will capture significant growth in the IoT market that is expected to be worth more than $14 trillion by 2022 (Accenture, 2016). However, Accenture's researchers concluded that these attempts might not reach the desired results - companies simply don't have capabilities to succeed in time of IoT revolution.

Nevertheless, the current IoT research is mostly written on the applied scale of technology in using IoT (Dachyar et al., 2019). It overlooks the importance of understanding the IoT from the managerial perspective, mainly focusing on developing technical parts of IoT (Dunaway Virginia et al., 2019). With the evolving understanding of IoT potential, more and more articles are focusing on the benefits and value that technology can provide and its role in industries development. In such a way, Dachyar et al. (2019) discovered the most influential topic for researchers so far, which is the emergence of 4^{th} industrial revolution where IoT is one of the key elements. However, the findings of consultancy companies such as Accenture shows that many of them are still not ready to go through it.

At the same time, the academic articles that could support companies in overcoming challenges and provide valuable information about the necessary firm's resources and ways how to orchestrate them in order to successfully apply IoT are simply missing that information. Even if the company does not suffer from the lack of resources, without an extensive knowledge of how these resources should be utilized, it is less likely that it successfully deploys the prominent technology. That brings firms to developing capabilities since new capabilities make new solutions possible, and needed solutions stimulate demand for new capabilities (Kane et al., 2015). Meantime, Sinha and Park (2017) point out that skills and capabilities required to win in this new world order are vastly different to what companies have cultivated over past several decades. Thus, the aim of this paper is to explore the organizational capabilities that firms need to have to realize IoT projects. In order to achieve this aim, the following tasks should be accomplished:

- Analysis of organizational capabilities of companies that implemented IoT
- Discovery of resources for organizational capabilities creation and development that are necessary for realization of IoT projects
- Discovery of routines supporting creation of organizational capabilities that are crucial for realization of IoT projects

As a result, the model consisting of organizational capabilities, resources and routines that support their development for successful IoT adoption will be developed.

CHAPTER 1. THEORETICAL BACKGROUND OF THE STUDY

1.1 Organizational capabilities

The capabilities and capabilities perspective on the firm have gained a lot of attention from researchers and have been developed in strategic management theory. The capabilities perspective has evolved within the resource-based view that sees resources as a key to sustainable competitive advantage (Wójcik, 2015). Barney (1991), the author of resource-based view concept, points out that a firm's resources are used to enable it to establish strategies to improve the overall efficiency and performance of the organization. These resources comprise all assets, capabilities, organizational processes, information, firm attributes, knowledge, etc. that are controlled by a firm and allow them to implement strategies that help to achieve their efficiency and effectiveness. Barney classified resources into 3 categories:

- Physical capital resources;

Including the physical technology used in a company such as firm's plant and equipment, its geographical location, and access to raw materials.

- Human capital resources;

These resources include the experience, training, intelligence, judgement, relationships, insight of managers and workers in firm.

- Organizational capital resources.

These resources comprise an organization's formal reporting structure, its formal and informal planning, controlling and coordination systems, informal relationships between groups within a firm and among a firm and those in its environment.

Grant (1991) offered a different approach to classify resources. In this taxonomy resources also comprise 3 categories such as tangible (including financial and physical resources), intangible (consisting of reputation, technology and organizational resources) and personnel-based (including training, culture, commitment, loyalty and knowledge).

Den Hond (1996) argues that capabilities can be also perceived as firm's resources but unlike traditional resources such as machinery and equipment, they are those resources that are intangible and tacit; they include the knowledge, experiences and skills of the firm's employees (blue-collar employees, white-collar employees, and managers) as well as organizational routines. In contrast, Lowe & Teece (2001) stress out that capabilities and competencies are not the same as resources. Instead, they characterize capabilities as "firm's access to resources and ability to mobilize and combine these resources in specific ways". In later work, Teece (2012) describes capabilities as firm abilities that enable it to efficiently perform current activities. In a similar way, organizational capabilities were defined by Dosi et al. (2000). The authors argue that organizational capabilities can be defined as know-how that allows firms to perform different sort of activities such as automobile manufacturing, identification and development of new pharmaceuticals and so on.

Residing in know-how as well as in experience and skills of firm's employees and managers as noted by Den Hond (1996), the nature of capabilities does not allow companies to exploit them as fast as tangible assets. They are supposed to be integrated in employees' working routines or the firm's organizational routines. The capabilities are tied with the process of learning both at the individual and the organizational level. However, transferring capabilities is not a simple process due to many factors, including tacit human skills involved, collective nature of the information, or idiosyncratic features of the context in which the knowledge is put to use (Szulanski, 1996). Den Hond emphasizes that capabilities transfer requires an established process in which tacit knowledge is converted to explicit knowledge and vice versa. That can be achieved by making know-how explicit ('externalization') or by 'socialization', learning by interaction with other employees.

Mayne et al. (2019) and den Hond (1996) argue that capabilities are capitalized on company's routines: "they exist in the form of routinized behaviors and practices" and "exploitation of the firm's capabilities can only take place through routinization". In fact, only regular and accepted deployment of knowledge, skills and experience, etc. lead to developed capabilities. Although den Hond mentioned that the tacit character of capabilities protects them from the imitation by other firms, Teece (2014) stressed that even though such capabilities and associated best practices are far from fully diffused globally, nowadays they can be easier imitated than they used to be. The know-how that was tacit during the time den Hond and other researchers issued their papers about firm's capabilities is now explicit and available from textbooks, Internet, consultants, business and engineering schools. Besides, Drnevich and Kriauciunas (2011) point out that ordinary capabilities are not enough for long-term survival and growth if firms are not acting in very stable and protected environments which is the rare case. Nevertheless, ordinary capabilities are vital for the corporate operations and companies should enhance them to the knowledge-intensive, performance-enhancing business activities in which the firm is particularly skilled (Teece, 2014).

While searching through the academic literature, it can be noticed that although the definitions and explanations of organizational capabilities are quite similar such as those by Dosi et al. (2000) and Teece (2012), the academicians often use different terminology. Thus, the organizational capabilities have been referred to many terms such as 'capabilities' by Amit and Schoemaker (1993), ‘combinative capabilities’ by Kogut and Zander (1992), ‘integrative capabilities’ by Verona (1999), ‘capacity to seize and to manage threats and transforming’ by Teece (2007) etc. (Rousseva, 2009). Describing organizational capabilities, many authors have used different wording, interchangeably orchestrating the words ‘ability’, ‘competence’ and ‘capability’ (Ulrich & Smallwood, 2004). Instead, Smallwood and Ulrich (2004) offer to make distinctions between them based on individual and organizational levels as well as social and technical skills set (Figure 1).

Differentiating Individual Competence vs. Organization Capability

	Individual	Organizational
Technical	1 An individual’s functional competence	3 An organization’s core competencies
Social	2 An individual’s leadership ability	4 An organization capabilities

Figure 1. Differentiating individual competence vs organization capability (Smallwood & Ulrich, 2004)

According to them, individual functional competence can be a technical expertise in finance or manufacturing, individual’s leadership ability might be an ability of a person to motivate people or define direction, organizational core competencies consist of firm’s core technical competencies, and, finally, an organization capabilities represent firm’s underlying DNA, culture, and personality. Each firm is unique and have different capabilities, so that there is no universal list of organizational capabilities. However, Smallwood and Ulrich identified 11 capabilities that well-managed companies tend to have. They comprise capabilities such as speed – ability to recognize opportunities and act quickly, whether to exploit new markets, develop new products, establish new employee contracts, or implement new business processes; and innovation – when the company focuses on the future rather on the past success in business strategies, products, processes, etc. All those capabilities can be found in Appendix 1.

Another one explanation of organizational capabilities that deserves to be mentioned was provided by Gebauer and Worch (2015). They describe organizational capabilities as firm-specific resources and processes to accomplish strategic goals by utilizing the available know-how and non-firm-specific resources. Taking into an account all interchangeable terms provided by other authors, this one serves as a short summary of them.

Many researchers tried to distinguish between different capabilities and provide their classification. Thus, the simplest approach to classify capabilities is to divide them to internal and external capabilities. According to Christensen (2002), the development of internal capabilities allows firms to perform a set of activities inhouse within the organization, while some elements of the value proposition can be outsourced to external players. Collis (1994) came up with four categories of capabilities, including first category capabilities that reflect an ability to perform the basic functional activities of the firm, second category capabilities comprising dynamic improvements to the activities of the company such as continuous improvement activities, third category capabilities that should recognize the intrinsic value of other resources or to develop novel strategies before competitors, and fourth category which is related to learning-to-learn capabilities. Winter (2003) offered three categories of capabilities: zero-level capabilities, first-order capabilities and higher-order capabilities. Zero-level capabilities can be described as 'how we earn and live' capabilities, which are crucial for the firms to collect the revenue from their customers and allow them to buy more inputs and do the whole thing over again. First-order capabilities are aimed on changing the product, production process and the scale of the customers/markets served. Finally, higher-order capabilities that heavily rely on the successful management of lower-order capabilities often have the greatest impact on the firm strategy (Hine et al., 2014). Foss (1996) describe them as non-proprietary and intangible assets that are shared among a group of firms and may include standards, knowledge-sharing in R&D networks, 'collective invention', etc.

Eventually, one of the most cited researchers in the field of capabilities, D. Teece, whose classification has become widely used, offered to divide organizational capabilities on ordinary (operational) and dynamic capabilities. According to Teece (2014), ordinary capabilities involve the performance of administrative, operational, and governance-related functions that are (technically) necessary to accomplish tasks. Meanwhile, Helfat and Winter (2011) stress out that operational capabilities enable firms to perform an activity on an on-going basis using more or less the same techniques or the same scale to support existing products and services for the same customer population. As follows, ordinary capabilities are important for the business performance.

Teece (2014) argues that typically ordinary capabilities fall into three categories: administration, operations, governance. Besides, they are embedded in some combination of:

- Skilled personnel, including, under certain circumstances, independent contractors
- Facilities and equipment
- Routines and processes, which include any supporting technical manuals

- Administrative coordination required to complete the job

At the same time, it is difficult to find any examples of ordinary capabilities in Teece's articles. Among the different authors interested in the organizational capabilities, the only attempt to classify ordinary capabilities was made by Wu et al. (2010). Based on the literature analysis they discovered 6 categories of ordinary capabilities and then by using a focus group research method, they could explore special ordinary capabilities related to these categories. The taxonomy of ordinary capabilities is presented in Table 1.

Table 1. Ordinary capabilities (adapted from Wu et al., 2010)

Ordinary capability	**Description**	**Examples**
Operational improvement	Differentiated sets of skills, processes, and routines that incrementally refine and reinforce existing operations processes	Process improvement to make cost competitive; Process standardization
Operational innovation	Differentiated sets of skills, processes, and routines that radically enhance existing operations processes or create and implement new and unique operations processes	Radical process innovation
Operational customization	Differentiated sets of skills, processes, and routines for knowledge creation through extending and customizing operations processes and systems	Process customization; Intellectual property and know-how (specialized tools, technology, equipment)
Operational cooperation	Differentiated sets of skills, processes, and routines that create stable and healthy relationships with people from different internal functional areas and external supply chain partners	Collaboration and trust with partners
Operational responsiveness	Differentiated sets of skills, processes, and routines for	Responsiveness;

	reacting rapidly and easily to changes in inputs or output requirements	Sense of urgency to meet short lead time; Fulfillment of customers' orders
Operational reconfiguration	Differentiated sets of skills, processes, and routines that allow to accomplish the necessary transformation to reestablish the fit between operations strategy and the market environment, when the balance between them has been interrupted	Change management

The strength of ordinary capabilities can be benchmarked internally or externally to industry best practices. If the company has achieved best practices and its employee base includes the relevant skilled people and advanced equipment, its ordinary capabilities can be considered as strong. However, the orientation on best practices can become a trap for the companies because in a pursuit of efficiency they might force out the capacity to effectuate change. In addition, top management can be distracted from bringing about the change mostly focusing on maintaining best practices and high productivity. Teece emphasizes that ordinary capabilities can best be thought of as achieving technical efficiency and "doing things right" in the core business functions of administration, operations and governance.

Nevertheless, even though a firm's ordinary capabilities support technical efficiency (and hence productivity), the achievement of best practices in ordinary capabilities is generally insufficient to ensure a firm's success and survival (Teece, 2007; Teece, 2019). Moreover, radical technological change often creates capability gaps for incumbent firms what incentivize them to develop or acquire new sets of capabilities to enter into a new technological subfield, commercialize new products, and incorporate the new technology to create value (Karimi & Walter, 2015). Karimi and Walter argue that in order to govern the rate of change in organizational ordinary capabilities and involve long-term commitment to specialized resources, firms need to develop dynamic capabilities, which are essential in responding to disruptive technological shifts.

There are different perspectives on dynamic capabilities. In early research on dynamic capabilities, Teece (1997) described them as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Eisenhardt and Martin (2000) claimed that dynamic capabilities are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die. Zahra and George (2002) provided different explanation of dynamic capabilities, emphasizing that they are essentially change-oriented capabilities which help firms redeploy and reconfigure their resource base to meet evolving customer demands and competitor strategies.

Unlike ordinary capabilities that are about doing things right, Teece (2014) stresses out that dynamic capabilities are about doing right things. In the ever-changing world, dynamic capabilities have become highly important, explaining why intangible assets have become the most valuable class of assets in a wide range of industries (Hulten and Hao, 2008). Dynamic capabilities allow companies and their top management to make hypotheses about the evolution of consumer preferences, business problems and technology; validate and fine-tune them; act on them by realigning assets and activities to enable continuous innovation and change. As an outcome, the strong dynamic capabilities support high performance based on new product and process development, a change-oriented organizational culture, and a prescient assessment of the business environment and technological opportunities (Teece, 2019).

Teece (2007) broke down dynamic capabilities into three primary clusters:

- Sensing – identification and assessment of threats, opportunities, and customer needs;

Teece (2019) highlights that sensing is an inherently entrepreneurial set of capabilities that involves exploration of technological opportunities, probing markets and listening to customers along with scanning the other elements of the business ecosystem. Some scholars exploring organizational capabilities argued that some technical activities require relatively little organizational expertise such as design. Thus, they distinguished technological capability which includes activities such as R&D, production, etc. that involve significant technological component. Rousseva (2009) stresses that technological capabilities represent the firm's capacities to manage new technologies, while organizational capabilities represent the capacities of the company to dealing with different business processes. Nevertheless, she concluded that almost all of the microfoundations of sensing are in essence technological capabilities (e.g directing internal R&D, tapping exogenous scientific and technological developments).

- Seizing – mobilization of resources to address fresh opportunities while capturing value from doing so;

After the opportunities are sensed, choices and following investments are made, the firm should seize these opportunities by choosing the right business model to satisfy customers, shape markets and market outcomes, and capture value.

- Transforming – ongoing organizational renewal.

Katkalo et al. (2010) emphasize that inherent continuous renewal and modification of transforming capabilities are aimed at maintaining competitiveness, as markets and technologies change. Teece (2019) points out that transforming capabilities are heavily relied on management's leadership skills.

Inan and Bititci (2015) based on the academic literature introduced the following examples of dynamic capabilities: R&D capability, innovation capability, product development capability, imitation/replication capability, reconfiguration capability, knowledge development/learning capability, networking capability, alliancing and acquisition capability, marketing capability.

While these capabilities are related to the characteristics of 3 microfoundations described by Teece, they are not particularly assigned to any of them. The other authors exploring dynamic capabilities have not assigned their findings to these specific microfoundations as well, though their researches were related to the theory developed by Teece. As in the case of ordinary capabilities, there were few attempts to make a taxonomy of dynamic capabilities. Thus, the noticeable classification was provided by Madsen (2010). He offered to divide dynamic capabilities in four groups:

1) External observation and evaluation

This group is tightly connected with what Teece called sensing capabilities. Madsen emphasized that this group include dynamic capabilities which monitor the environment, provide impulse to new ideas, explore new possibilities and evaluate them. Some of these capabilities are based on Teece's findings such as abilities to scan the environment to evaluate the markets and competitors, assessment of strategic alternatives, benchmarking and observation of markets and technologies. Other include idea generation capability, strategic path aligning capabilities, external reconfiguration and integration capability. According to the Teece's theory, the last one is more related to seizing capabilities.

2) Internal resource renewal

This group include dynamic capabilities that integrate new resources in original and effective resource configurations. According to Madsen, this group comprises knowledge reconfiguration, new process development and new product development capabilities, internal integrative capabilities, innovative capabilities, R&D capabilities, market disruptiveness capabilities.

3) External resource acquisition

The third group consists of dynamic capabilities that acquire and/or link the firm to external resources. That can be achieved by developing resource acquisition capabilities, learning network capabilities and collaboration capability.

4) Internal resource reconfiguration

The last group include dynamic capabilities that reconfigure or restructure internal resources. This group is similar to transforming microfoundation and comprise internal resource integration capability, internal flexibility capability and upgrading the management capability. The internal resource configuration requires constant change which is impossible if a firm is unable to integrate knowledge, restructure or reengineer its process and to learn.

Obviously, the necessary capabilities cannot just appear in a company, they are the result of the people's effort. In such a way, the management plays a tremendous role for building dynamic capabilities. That was recognized in different Teece's articles: 'the effectiveness of resources redeployment is a reflection of management's competence in recognizing and seizing opportunities, which are, in turn, part of the organization's dynamic capabilities' (Teece, 2007) and 'in the dynamic capabilities framework management plays a distinctive roles in selecting and/or developing routines, making investment choices, and in orchestrating nontradable assets to achieve efficiencies and appropriate returns from innovation' (Augier & Teece, 2009). In addition, Leih and Teece (2012) pay attention to the fact that not only top but also middle managers are important for dynamic capabilities as they source knowledge inside and outside the organization, develop new ideas and share them, interpret firm's strategy for employee, and facilitate rapid implementation of transformation if needed.

Ordinary (operating) and dynamic capabilities being the parts of organizational capabilities were also discussed by researchers in terms of their relationships. In such a way, Zahra and Newey (2009) pointed out that dynamic capabilities are the ability of the firm to reconfigure operating capabilities and thus allow the organization to adapt and evolve, while Helfat and Winter (2011) suggested that dynamic capabilities are used to extend or modify their current resources in different ways such as altering operational capabilities. Teece (2014) presented the logical structure of the dynamic capabilities framework (Figure 2) which encompasses both ordinary and dynamic capabilities.

According to this framework, organizational capabilities are supported by valuable, rare, imperfectly imitable, and non-substitutable (VRIN) resources. A firm should have both strong dynamic and ordinary capabilities but unlike dynamic, ordinary capabilities are not enough for long term financial success and may not even be necessary. That way, they must be accessed by the enterprise, but not necessarily should be owned. Moreover, Teece (2014) emphasizes that managing a plethora of ordinary capabilities might undermine dynamic capabilities. The effectiveness of dynamic capabilities is also dependent on the firm's strategy – the greater the diversity and rate of change in business environments, and the greater the importance of intangible assets, the more critical good strategy and strong dynamic capabilities become. Thus, if a firm operates under such conditions and ordinary capabilities are easily imitable, a firm should pay more attention to dynamic capabilities, while in more stable business environments, especially if company doesn't have strong capabilities, the main focus should be on developing ordinary capabilities.

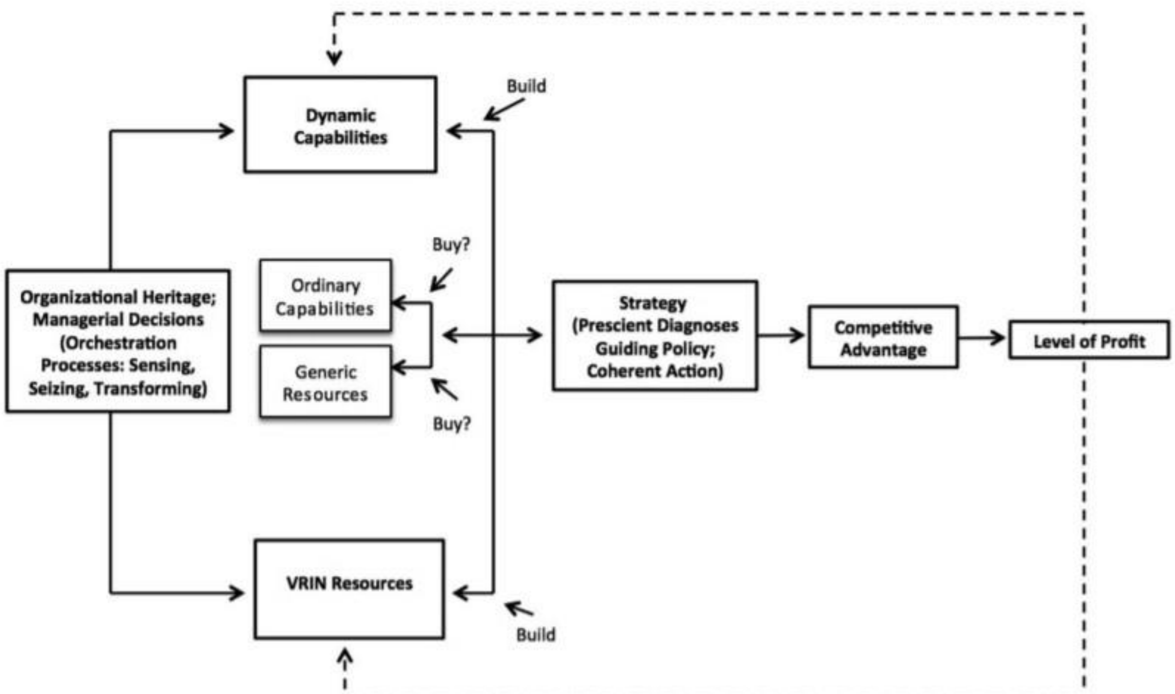

Figure 2. The Logical Structure of Dynamic Capabilities Framework (Teece, 2014)

As we can see from the aforementioned taxonomies, the ordinary and dynamic capabilities being the parts of a firm's organizational capabilities do not operate alone and drive company performance.

Although Teece makes a distinction between ordinary and dynamic capabilities, the current literature cannot define a precise boundary between these capabilities. For instance, Wu et al. (2010) included operational reconfiguration to the ordinary capabilities' taxonomy, while to their nature and the theory provided by Teece, such capabilities can be described as dynamic since they are related to the process of firm's transformation and its resources reconfiguration. Nevertheless, there is no huge contradiction and they can be related to both groups. As different authors such as Helfat and Winter (2011) and Inan and Bititci (2015) concluded, there is no certain line between dynamic and ordinary capabilities because change always occurs to at least some extent and some capabilities can be used for both operational and dynamic purposes.

Overall, as we can notice from the studies about organizational capabilities, both ordinary and organizational capabilities play an important role in achieving organizational performance excellence and realization of different kind of projects. However, the current research of organizational capabilities is mostly related to their importance in achieving a competitive advantage and ignores organizational capabilities related to the adoption of new technology such as IoT which is reshaping our world. The utilization of IoT which is the way for companies to introduce new goods, methods of production or reinvent the firm's operations requires firms to develop their own unique knowledge and resultant capabilities that engender organizational performance (Knight & Cavusgil, 2004). Thus, the organizational capabilities required for realization of IoT project should be explored but beforehand, it is necessary to have a look on the technology itself and understand its context.

1.2 Theoretical background of the Internet of Things

Despite the prominent opportunities of IoT for companies, these opportunities may never be utilized due to many unsolved challenges related to the nature of IoT. The inherent complexity of IoT, that is one of the biggest challenges for companies implementing the technology, requires a comprehensive understanding of what Internet of Thing is. Similar to artificial intelligence, blockchain and many other trending digital technologies, there is much uncertainty when it comes to defining their meaning, what makes impossible to provide only one definition that could be acceptable by the world community of users. The Information Telecommunication Union defines IoT as a global infrastructure for the information society, enabling advanced services by interconnecting physical and virtual things based on existing and evolving interoperable information and communication technologies. Komninos et al. (2011) stresses that Internet of Things is considered as a major research and innovation stream leading to plenty opportunities for new services by interconnecting physical and virtual worlds with a huge amount of electronic devices distributed in houses, vehicles, streets, buildings and many other public environments.

In fact, the vision of IoT can be interpreted from different perspectives. From the viewpoint of services provided by things, IoT is "a world where things can automatically communicate to computers and each other providing services to the benefit of the human kind", from the viewpoint of communication it is "a world-wide network of interconnected objects uniquely addressable, based on standard communication protocols" and from the networking side IoT is the Internet evolved "from a network of interconnected objects" (Gil et al., 2016). Another one definition is based on the common idea of other explanations, which assumes that the first version of the Internet was about data created by people, while the next one is about data created by things. This way, IoT can be described as "an open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in face of situations and changes in the environment" (Madakam et al., 2015). All in all, the definitions of IoT emphasize the ability of technology to connect things/intelligent objects and to exchange information. Following this implication, it is necessary to define what are the things/intelligent objects that can be connected and how this process flows.

The term "things" is typically used by standard-setting organizations such as Institute of Electrical and Electronics Engineers (IEEE), ITU, etc. According to IEEE, the "thing" can be any physical object that is relevant from a user or application perspective (Liu & Baiocchi, 2016). Internet Engineering Task Force (IETF) organization put some examples of things that can be a computer, a sensor, people, a car or a book. To call them things in the context of IoT, they should be identified by one unique way. The identified thing is called an object. In contrast, academicians pay more attention to the term "smart objects" which is used more often than "intelligent objects" (Hernández & Reiff-Marganiec, 2014). Smart object is an autonomous, physical digital object augmented with sensing/actuating, processing, storing, and networking capabilities. From perspective of smart objects IoT seen as a loosely coupled, decentralized system of cooperating smart objects (Fortino et al., 2014).

The cooperating things/smart objects can fall into several categories: consumer, business: cross-industry, business: vertical-specific (Gartner, 2017). Consumer IoT applications can range from very simple ones such as personal fitness devices to high-end smart home automation applications. The good example of consumer IoT was provided by Hoffman & Novak (2015), it is a doorbell/lock as an alert device. When connected to the Internet and to the camera, the doorbell/lock and camera assemblage enables the homeowner to see who is at their front door and to speak and interact with the visitor, even when they are not physically at home. The illustration of cross-industry IoT can be smart buildings including devices such as LED lightning or physical security system. Among the vertical-specific applications are manufacturing field devices and process sensors for electrical generating plants.

In more detail, the application of IoT was described by Gil, Ferrandez, Mora-Mora and Peral (2016), they divided IoT applications into 3 big sets: industry and business, smart city, health. Figure 3 shows the IoT application domains according to them.

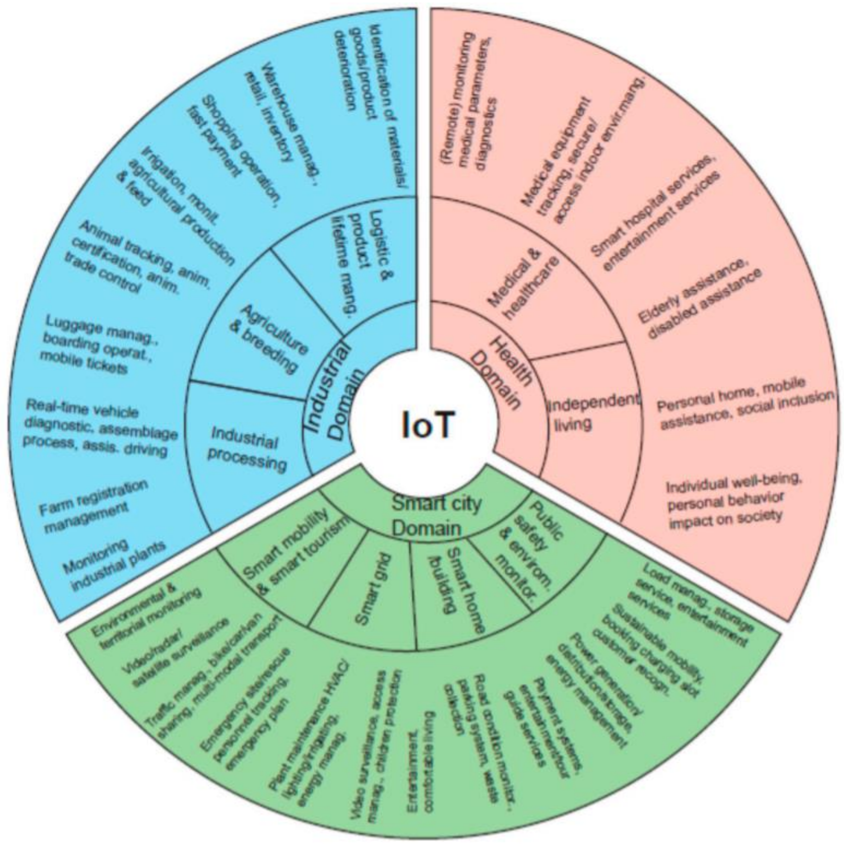

Figure 3. IoT application domains (Gil et al., 2016)

Each of the categories is divided for subcategories. For instance, industrial domain consists of logistic and product lifetime management, agriculture and breeding, and industrial processing. However, there is no single taxonomy and various authors offer different IoT application domains such as classification introduced by Atzori et al. (2010) where they identified transportation and logistics domain; healthcare domain; smart environment (home, office, plant) domain; personal and social domain.

According to Madakam et al. (2015), the successful implementation of IoT regardless of domain depends on dynamic resource demand, real time needs, availability of applications, exponential growth of demand, data protection and user privacy, efficient power consumption of applications, execution of the applications near to end users, access to an open and inter operable cloud system. Seamless IoT computing requires 3 components:

- Hardware – composed of sensors, actuators, IP cameras, CCTV and embedded communication hardware;
- Middleware - on demand storage and computing tools for data analytics with cloud and Big Data analytics;
- Presentation - easy to understand visualization and interpretation tools that can be designed for the different applications.

Another authors such as Whitmore et al. (2015) pointed out that IoT is based on hardware, software and architecture. Critical hardware infrastructure comprises RFID, NFC and Sensors Network, where RFID is a specifically created short-range communication technology for the IoT that enable to read special tags through radio-frequency electromagnetic field. NFC is also a short-range communication technology but unlike RFID, it enables two-way communication, allowing NFC-enabled gadget to both send and receive information. Typically, NFC technology installed in smartphones.

Another one component, sensors network, is a technology allowing to monitor the indicators of environment such as temperature, quantity, movement and humidity. Besides, actuators that sensors network contains can perform actions to affect the objects by emitting light, sound, and radio waves.

The software is presented by middleware ad semantic model of middleware where middleware supports in gathering all devices and data together making possible the development of new IoT services and their deployment without a need to write different code for each kind of devices. In turn, semantic model of middleware aims on creating a common framework that helps to share the data across all distributed devices, sensors and applications. Finally, architecture includes hardware/network architecture, software architecture and process architecture that focus on representing, organizing and structuring IoT technologies.

In addition, Sikder et al. (2018) identified four IoT architecture layers and components which include hardware, middleware and presentation. These layers are represented in figure 4.

The first, sensing layer, includes free categories of sensors: motion sensors, environmental sensors (e.g. light sensor) and position sensors (e.g. GPS). These sensors are aimed on identifying any phenomena in the devices' peripheral and obtaining data from a real world. After data is collected, it should be transferred through the communication channel, represented by network layer, by using various technologies such as Bluetooth, Wi-Fi, RFID, NFC, Z-wave, etc. Then the received data should be processed. The data processing layer analyzes collected data and take decisions based on results. In addition, it can share the processed data with other connected objects via network layer.

Objects in an IoT must be able to communicate and exchange data with each other autonomously (Mitrokotsa et al., 2010). It is a critical requirement of an IoT that the things must be interconnected. As a result, the outcomes of data processing layer are presented in application layer which executes different tasks for the users.

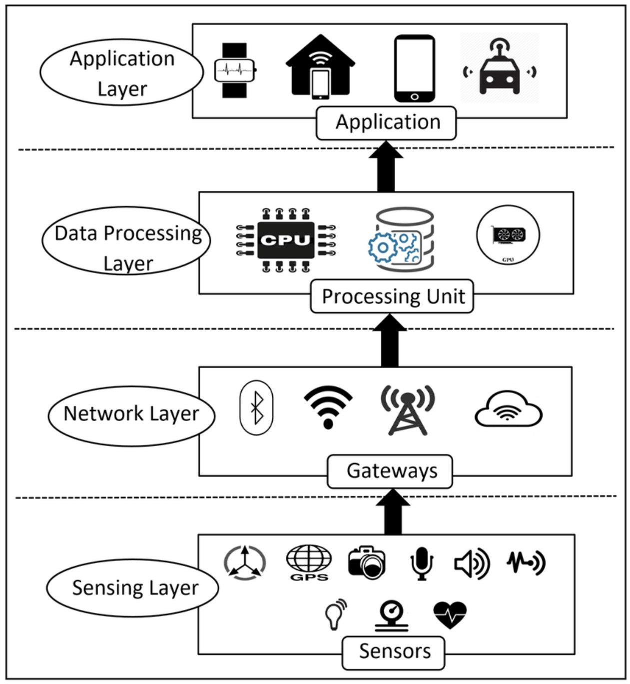

Figure 4. IoT Architecture Layers and Components (Sikder et al., 2018)

The management of sensors and IoT-enabled devices is highly valuable for companies to monitor a product condition, external environment and product usage. However, the monitoring is only one step in exploration of IoT's full potential. Ericsson (2015) presented the IoT maturity model (Figure 5) that sheds light upon the IoT evolution.

The model consists of five stages namely monitoring, control, optimization, autonomy, systems autonomy. After the first step that was mentioned before, companies that developed special algorithms and software may enable their products to respond to specific changes in its conditions or environment. During the Optimization stage, analytics allow the product to continuously and automatically advance its performance. On the next level, product is able to perform without human interference, adapting to environment changes and customer preferences. The full potential of IoT is achieved on the fifth step when product not only work autonomously but also communicate with other connected things influencing on their functionality.

Ericsson notices that, in fact, not every company needs to go through all steps if such a step doesn't meet goals of a company. At the same time, to climb through these steps and reach the highest level, companies need to develop special capabilities.

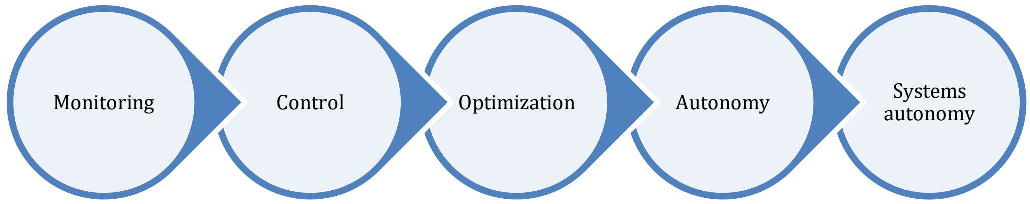

Figure 5. IoT maturity model (Ericsson, 2015)

As we can see, the IoT system comprised of elements and technologies mentioned above is a hugely complex organism. In order to make that complex organism work, organizations need not only to bring the necessary elements together but also to have significant level of system integration and standards development (Holler et al., 2014), which in turn is not possible if they have not acquired the needed capabilities, skillsets and people (Prybylski, 2019).

1.3 Organizational capabilities required for realization of IoT projects

Brous et al. (2019) argue that implementation of the Internet of Things like other technologies adoption introduces unforeseen risks and requires substantial organizational transformations. According to them, firms often underestimate the impact that IoT adoption has on the organization, and often do not fully understand the organizational conditions and consequences of successfully adopting IoT. That conclusion has practical evidence, thus, the failure rate of IoT projects has been stable from 2017 when Cisco revealed that 75% IoT projects are not able to be accomplished (Safeatlast, 2019). Emphasizing various problems underlying this number, researchers agree that currently the adoption rate of IoT is slow.

Meanwhile, the adoption of IoT depends on having certain technologies, organizational capabilities and policies in place (Dalipi & Yayilgan, 2016). The Capgemini (2018) study showed that among organizational capabilities, a big role plays analytical capabilities, allowing companies to take an advantage of the data generated from IoT sources. However, 60% of organizations admitted that they have a lack of them.

Klein et al. (2017) investigating challenges on the developing IoT business models revealed that some of them are related to the firm's internal capabilities. According to them, companies struggle during the identification of specific organizational capabilities to support the strategic implementation of IoT based products/services.

The importance of the identification of such capabilities was supported by Burkitt's (2014) research where he made several examples of the companies applying IoT with respect to the organizational capabilities. For instance, Estimote firm produced beacons that stick to objects and send signals through low-frequency Bluetooth transmissions. However, they didn't have capabilities to move beyond their endpoint and connectivity products, so they focused on them to overcome these constraints. Further, they leveraged IoT technologies and designed a new device called "Estimote LTE beacon". These beacons can be applicable in retail stores, communicating with enabled devices like smartphones and tablets, and providing the retailer with information about items that customers pick up or how much time they spend considering the purchase. If retailers want to utilize IoT this way, they also need to develop special capabilities, at least in proximity marketing.

In order to figure out what capabilities are important for the companies stepping into the IoT future, it is crucial to first understand who these companies are. Burkitt (2014) introduced three strategic categories, each reflecting a different type of enterprise:

- "Enablers" that develop and implement the underlying technology;

These are primarily technology-oriented companies such as Intel, IBM, Cisco, Google who build and maintain critical infrastructure that allows Engagers to create their own connected services. Among their offerings are the endpoint, hub, network and cloud service technologies such as devices, connectivity hardware and infrastructure, etc. Each enabler must decide the appropriate scale and scope for its business based on the capabilities it can master and base the strategy on the most distinctive capabilities it can offer.

- "Engagers" that design, create, integrate, and deliver IoT services to customers;

Engagers provide the direct link between IoT and the market using critical infrastructure by Enablers and, as a result, produce services for consumers and businesses. Most of these companies do not begin as IoT firms, rather come from non-IT industries such as auto manufacturing, insurance, retail, etc., expecting enormous opportunities providing by IoT. The smart home, the connected car, the digital factory – all of them represent Engagers. Burkitt emphasizes that winners among Engagers are not necessarily have the most sophisticated technology or biggest cloud, they rather have the right capabilities.

- "Enhancers" that devise their own value-added services, on top of the services provided by Engagers, that are unique to the Internet of Things.

Enhancers that just recently started to appear in the IoT ecosystem provide integrated services that reframe and repackage the products and services of the Engagers, succeeding by finding new ways of creating and extracting value from the data, relationships, and insights generated from the IoT activity. They have to look into business and technological issues, such as how to share data with existing hubs and services, and how to structure business partnerships. In terms of capabilities, they need to develop a strong innovation capability, oriented around developing and continually updating their suite of services connected to the IoT.

For each category and, particularly firm, the set of capabilities may vary, however Burkitt argues that companies need to develop so-called "table stakes" capabilities that all IoT firms must have. Among them he identified the ability to manage and analyze huge quantities of data, to integrate diverse portfolios of services, and to build business relationships with other IoT-related companies, some of which may have contrasting cultures.

Porter and Heppelmann (2014) argue that IoT adoption requires significant investments in specialized skills, infrastructure and technologies which have not been typically presented in companies. This calls firms for a realistic assessment of which capabilities should be developed in-house and which should be outsourced (Klein et al, 2017). While it is up to the company to decide which of capabilities should be built internally, the environment of modern digital world can have an impact on such decisions. Jeff Immelt, the former CEO of GE, said that "every industrial company will become a software company" what with an alignment to the nature of technology for smart, connected products, makes it clear that building internal software capability for firms will be crucial. At the same time, Porter and Heppelman (2014) notice that the choice for in-house development may lead to self-overestimation and potentially end up in slowing down the development timeline. They claim that firm's focus should be on the technology layers that may bring the greatest opportunities for product insight, future innovation, and competitive advantage, outsourcing those that will become commoditized or advanced too fast. Consequently, most companies should strive to maintain solid internal capabilities in areas such as systems engineering, data analytics, and rapid product application development. In addition, the great attention should be paid to security-related capabilities: "when security requirements are high, companies will need capabilities to protect the data and limit transmission risk by storing data in the product itself".

Another study by Fumikho Isada and Yuriko Isada (2019) revealed that IoT-related business needs a cooperation with a broader system and various types of technological knowledge what makes open innovation useful for these companies. However, they noticed that various external cooperative arrangements could pose a threat for profitability since IoT is still in the early phase and R&D for associated technology has high uncertainty. In order to avoid this trap, companies need to have strong selective capability which should help them to carefully and successfully select the right partner. Moreover, it is important to make it quickly because in IoT business transitions of technical and management environments are rapid and require selecting an alliance partner quickly, carry out a product concept quickly and to judge success or failure quickly. Besides, to make a good selection, the firm needs to heighten search capability. To support these capabilities, companies need to build-up of human capabilities such as the employment of talented people with external relationship experience, what in turn will lead to wisely chosen partners and provide company with a profit.

Overall, the overview of identified capabilities that are important for realization of IoT projects are presented at the Table 2.

Table 2. Explored organizational capabilities that are important for IoT projects realization

Explored capabilities	Sources
The “table stakes” capabilities required for realization of IoT projects include the ability to manage and analyze huge quantities of data, to integrate diverse portfolios of services, and to build business relationships with other IoT-related companies	Burkitt, F. (2014). The digital interconnection of billions of devices is today’s most dynamic business opportunity. *Pwc*, *77*, 12.
The crucial role for companies play analytical capabilities because they allow companies to take an advantage of the data generated from IoT sources	Capgemini (2018). Unlocking the business value of IoT in operations.
Building internal software capability is crucial for the company	Porter, M. E., & Heppelmann, J. E. (2014). How Smart, Connected Products Are Transforming Competition. (Spotlight On Managing The Internet Of Things). *Harvard Business Review*, 92(11), 64.
Companies have solid internal capabilities in areas such as systems engineering, data analytics, and rapid product application development as well as security-related capabilities	Porter, M. E., & Heppelmann, J. E. (2014). How Smart, Connected Products Are Transforming Competition. (Spotlight On Managing The Internet Of Things). *Harvard Business Review*, 92(11), 64.

Companies implementing IoT need to have selective capability, search capability and human capabilities such as the employment of talented people with external relationship experience	Isada, F., & Isada, Y. (2019). Interorganizational Relations and Organizational Capabilities in Internet of Things Businesses. International Journal of Business and Management, VII(1), 48–62.

1.4 Research gap

Promising giant opportunities for companies, IoT has brought the uncertainty to the company's future. Realizing that the emerging technology can increase the companies' efficiency from operational improvements to created new products and services, many executives took into an account the possibility to utilize IoT. Nevertheless, in pursuit of adopting the technology to overcome the competitors, many companies faced huge barriers which led to the failed projects. Different authors emphasized various problems underlying the high failure rate of IoT projects including the absence of capabilities in companies implementing IoT as one of the main reasons.

At the same time, Smallwood and Ulrich (2004) emphasized that "the magic list" of capabilities appropriate to every organization doesn't simply exist. Instead, a set of each firm's capabilities should reflect its strategic goals. Subsequently, companies must identify and build capabilities that will have the strongest and most direct impact on the execution of strategy. Nevertheless, plenty of companies whose strategy involves the adoption of the Internet of Things for the creation of IoT-enabled products and services are struggling with such an identification.

On the one hand, we can observe a situation when companies adopting IoT might also require different capabilities since the strategic purposes of technology implementation may vary. On the other hand, as it was mentioned by Burkitt (2014), companies that make IoT projects need "table stakes" capabilities applicable for all of them that serve for technology successful utilization. The logical question following this implication is what are they? What are the organizational capabilities that companies need in order to adopt IoT for their IoT-enabled products and services? Currently, the research about organizational capabilities lacks to provide information about necessary organizational capabilities for such projects, and IoT-related literature is mostly focused on technical aspects and strived to explain what product capabilities firms should have leaving Enablers, Engagers and Enhancers without an answer about what are the "table stakes" capabilities that all of them must have in order to get advantage of IoT.

As we can see from the literature review, even though there were some attempts to shed the light on what organizational capabilities are required for realization of IoT projects such as by Burkitt (2014) who highlighted 3 of them, some other authors pointed out additional capabilities leaving this question without a definite answer. As a result, no theoretical model related to organizational capabilities required for realization of IoT projects exists.

Besides, the identification and development of capabilities relies heavily on specific resources since capabilities are the capacity to deploy a combination of resources through collective organizational routines (Galavan, 2015). Since organizational capabilities require orchestrating of such resources, they also need to be identified as well as organizational routines, however this information is also missing in academic literature. Thus, the research gaps are clear, bringing the necessity to answer the following research questions:

- What organizational capabilities companies should have for realization of IoT projects?
- What are the necessary resources for creation and development of organizational capabilities needed for realization of IoT projects?
- What are the necessary organizational routines for creation and development of organizational capabilities needed for realization of IoT projects?

Based on the literature review in this chapter, we can formulate the study propositions that provide the structure for analysis.

Proposition 1: The organizational capabilities required for realization of IoT projects include:

- Ability to manage and analyze huge quantities of data
- Ability to integrate diverse portfolios of services
- Ability to build business relationships with other IoT-related companies
- Analytical capabilities
- Internal software development capability
- Systems engineering capability
- Rapid product application development capability
- Security-related capabilities
- Selective, search and human capabilities

Proposition 2: The organization should have the following resources:

- ICT resources composed of hardware including sensors, computers, servers, and software

- Human resources including developers, engineers, managers, and their knowledge related to software development, systems engineering, data management, product development and partnerships development

During this study, we are going to test whether the abovementioned capabilities and resources are necessary for realization of IoT projects, identify what are the accompanying routines and explore if there are other capabilities required for IoT projects realization the current studies have overlooked.

CHAPTER 2. RESEARCH METHODOLOGY

2.1 Research design

In order to answer to the questions mentioned in the previous chapter, the exploratory study was used since it is the most useful and appropriate research design that is addressing a subject about which there are high levels of uncertainty and ignorance, and when the problem is not very well understood (van Wyk, 2012).

Indeed, based on the literature review, we identified that the organizational capabilities needed for realization of IoT projects were mostly ignored by academicians. In this case van Wyk suggests employing ethnographic-inductive logic that begins with making observations and collecting data before describing theoretical implications of what researchers saw/heard. After that, it is possible to build a theory which in our case is a model consisting of required organizational capabilities, which are based on organizational routines and resources, that are required for realization of IoT projects.

For the aim of this study, we need to derive in-depth understanding of the phenomena, which is possible by using the case study method – an empirical inquiry about a contemporary phenomenon (e.g., a "case"), set within its real-world context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2012). According to Eisenhardt (1989) this method is especially appropriate in new topic areas. The exploratory case study method provide researcher with an opportunity to closely examine the data within a specific context (Zainal, 2007) and is useful to answer on the question "what?", which is used in all research questions of this paper. In this study we want to see whether the explored IoT-related organizational capabilities are required for realization of IoT projects, reveal what are the other important IoT-related organizational capabilities and based on that generate a theory. Eisenhardt (1989) argues that for aims such as generating a theory, the case study is the most appropriate method.

The case study can be multiple and single. Although the multiple case studies are useful for building better grounded and more accurate theory, for the aim of this study we use single case study method since it enables the creation of more complicated theories than multiple case studies and single-case researchers may fit the theory exactly to the many details of particular case (Eisenhardt, 2007). Since the current research does not provide much information about organizational capabilities, resources and routines required for realization of IoT project, we assume that by performing single case study we can deeply understand the context of IoT projects and its specifics, what will allow us to create a more comprehensive theory.

As a first step of this method, we defined the “case” which is generally a bounded entity such as a person, organization, event, etc., and serves as the main unit of analysis. In this study, the main unit of analysis is a company realized IoT projects. In fact, it is only possible to reveal organizational capabilities needed for realization of IoT projects by observing a company that already adopted the technology and track what capabilities were developed for realization of such a project. Therefore, the chosen case was selected based on IoT technology utilization. Since “table stakes” capabilities are required for every company realizing IoT projects, we selected company that represented Engagers, Enablers or Enhancers. When choosing the case for single case study, Yin (1994) claims that it should be chosen if it provides unusual revelatory, extreme exemplars or opportunities for unusual research access. That is why we chose GO+ company. It represents both Enablers since it built own critical infrastructure to allow Engagers to create their own connected services and Enhancers since based on products and services that provide Engagers who are the partners of GO+, the company creates and extracts additional value that allow to provide its new own services. Besides, the case of GO+ clearly shows how the IoT projects can be started from the scratch since company’s journey started from non-IoT company. Thus, the case of GO+ is relevant for this study.

As a second step, we applied the existent theoretical findings regarding organizational capabilities required for realization of IoT projects. These theoretical findings are presented in Table 2. As we can see, some authors discovered several organizational capabilities that might be significant for realization of IoT projects. During the study we assess whether these capabilities occur in the case, so we can approve or reject their necessity for realization of IoT projects and, hence, include in our model.

2.2 Data collection

In order to collect the data required to throw light upon the organizational capabilities, we utilized data collection method, named, semi-structured interviews with open-ended questions. This type of interviews serves as a middle ground between structured and unstructured interviews that provide detail, depth and insider’s perspective (Leech, 2002). Besides, this method would allow us to see whether the findings from the academic literature about organizational capabilities could be approved. As it is stated by Oun and Bach (2014), semi-structured interviews provide the opportunity to have a discussion in details but within the boundaries of the topic, and allow the researcher to be free to direct the interview based on the quality of the answers from the interviewee. Thus, the interviews were built around core questions that served as “the boundaries” and were aimed on answering to the research questions of this paper.

These core questions were based on the literature review, including the following questions:

- What are the resources that were used to realize IoT projects?

That question is based on the nature of organizational capabilities described by Galavan (2015) who defined them as the capacity to deploy a combination of resources through collective organizational routines. The following up question of how these resources were used together was also made.

- What are the routines that help company to deploy a combination of resources?

This is a logical question following the same definition by Galavan (2015). Besides, as it was mentioned in the literature review, development of capabilities can be achieved only by routinization.

Since the capabilities are embedded in some combination of skilled personnel and administrative coordination (Teece, 2014), the following two questions were included to the interview agenda:

- What skills and knowledge employees of the company has that helped them to realize IoT projects?
- How the work is organized and team is managed?

To assess whether the organizational capabilities explored in the literature review are applicable to the case company, the following questions were developed:

- Could you describe how you work with data?
- Could you describe your relationships with other IoT-related companies?
- Could you describe whether it is crucial for your company to develop software internally or you can outsource its development?
- Could you describe practices in talent’s acquisition for your company?
- Could you describe how do you solve security-related issues?

Moreover, to achieve a deep understanding of the case company, it was crucial to know how the company has been developed and what projects it realized. In fact, by asking the general questions about the company and its history, during the interview we received the deep information about the interests of our research that allowed us not to ask some questions described above. However, some follow-up questions based on information received were made in order to have the full picture of the case company and the organizational capabilities required for realization of IoT projects. The full list of questions asked during the interview can be found in Appendix 2.

The interview was conducted with the founder, CEO and CTO of GO+ company Alexey Sidorenko. Alexey has a deep knowledge of the company and its operations. He is experienced in systems engineering, software development and business administration. Under his supervision the company has successfully developed IoT platform GO+ and run IoT-based services. The exhaustive information provided by Alexey was highly valuable for this study and allowed us to achieve its aim.

Besides, we extended our research and conducted another interview with the expert in the IoT field and external advisor, Rob van Krannenburg. Rob is the founder of Council IoT and included in top 100 IoT influencers in the world. He has a huge experience in the field of IoT helping not only small companies but also big ones such as Siemens providing his expert view and conducting research as well as acting as an Ecosystem manager (e.g. EU projects Tagitsmart and Next Generation Internet).

As in the interview with Alexey, the core questions have remained the same, so we controlled the agenda and extracted the more valuable information related to the aim of the research. Some of them were adjusted to gain the view not only about the case of GO+ but also to hear the information about other IoT projects where Rob has participated. The questions of this interview are presented in Appendix 3.

The both interviews were conducted in Skype and lasted roughly 3 hours in total. The information provided by the case company founder and the expert in IoT field allowed us to further form the comprehensive theory.

2.3 Validity and reliability

Choosing case study as a research method usually pose a threat about validity and reliability. Kvale (2006) argues that the quality of results depends on how similar it is to the phenomenon that is investigated. While investigating organizational capabilities based on GO+ case, we can claim that the results are congruent with the exploring phenomenon since the company has successfully realized IoT projects. The interview with Alexey Sidorenko can be perceived with high validity because it included the deep explanation of the company, its projects, the work organization, operational flow, interactions inside the company, team experience, etc., what, in turn, allowed to cover all issues needed to be cover. To achieve credibility of the research, data was collected from the different points of view. The second interview with external advisor with the great expertise in IoT increased the validity as well by checking and confirming the findings from interview with Alexey.

Rowley (2002) claims that to establish the quality of case study research and achieve good validity, the researchers need to use case study protocol. The case study protocol covers an overview of the case study project, resources of information and case study questions. All elements of the case study protocol are presented in this paper.

Christie (2000) argues that reliability deals with the ability of other researchers to carry out the same study and achieve similar results. Among the approved techniques for increasing the reliability, the author emphasizes the establishment of a case study database. Thus, to increase transparency and reliability, we created the database comprised of interview protocols and researcher’s notes. The model appeared from the case study is connected to the data gathered during this study and compared with the literature review.

2.4 Data analysis

Houghton et al. (2015) argues that the analysis of qualitative data has no systematic rules and represents the most complex and mysterious phase of a qualitative research project. In fact, the challenge of a case study is to creatively and rigorously organize, find patterns and elicit themes from the data. Since the overarching goal of data analysis is the theory development, the collected data should be evaluated by assigning general concepts (codes) to singular incidences of data (Vollstedt & Rezat, 2019).

For the aim of this paper we used the coding methodology suggested by Corbin and Strauss (2008). The initial step of coding was the preparation of interviews’ transcripts. The transcripts were created right after the interviews were conducted.

Corbin and Strauss distinguish between 3 types of coding that are needed to develop a grounded theory: open, axial, and selective coding. We utilized open coding procedure as a next step which aim is to conceptualize and categorize the phenomena through an intensive analysis of the data. In such a way, we broke data into smaller chunks in order to grasp the core idea of each part and to assign names that could describe them. The codes or names as they are called by Corbin and Strauss could be assigned in two ways: as constructed codes, and as “in vivo codes”. The constructed codes are labelled by the analyst according the personal perception and imaginary. The “in vivo” codes are taken directly from data using interviewee’ description. We used both approaches since “in vivo” coding helps better understand the slang (Manning, 2017) which is special in the IoT context.

After we assigned open codes, the axing coding technique was used. Corbin and Straus (2008) argue that by axial coding it is possible to investigate relationships between concepts and categories that have been developed in the open coding process. The defined open codes were grouped into categories supported by classification of organizational capabilities and resources provided in the first chapter.

The final coding step, selective coding, which goal is to integrate the different categories that have been developed, elaborated, and mutually related during axial coding into one cohesive theory (Vollstedt & Rezat, 2019), was performed. The authors claim that selective coding is similar to axing coding. In fact, these coding techniques are quite similar, however selective coding is carried out on a more abstract level. In such a way, we connected and organized codes within one concept to create meaningful core categories. The connected categories allowed us to further develop a theory consisting of organizational capabilities, resources and routines required for realization of IoT projects.

As a result of the coding we assigned 3 general code categories related to the research questions: Resources, Routines and Organizational capabilities.

The resources coding is presented in the Appendix 4. As it is stated by Corbin and Strauss (2008), we started with line-by-line coding and assigned different codes such as MQTT and CoAP which were labelled “in vivo” following the information provided by Alexey: “After that we came up with a general consensus that MQTT was widely used protocol”, and “We looked at the range of the protocols that existed and came to MQTT and CoAP that we plugged in later”. This codes then were grouped and assigned to the category “IoT protocols” what, in turn, was assigned to the category of “Technical knowledge”. Following the same logic as described by Corbin and Strauss we elicited all meaningful codes, created categories, and connected them. The coding for routines is presented in Appendix 5, and coding for organizational capabilities is presented in Appendix 6. The connected categories allowed us to further develop a theory consisting of organizational capabilities, resources and routines required for realization of IoT projects. The developed theory is presented in the following chapter.

CHAPTER 3. Case study – GO+

3.1 Case description

The case study company – GO+ is a provider of an IoT cloud platform that is designed to connect and control heterogeneous IoT devices, manage and analyze obtained data. The GO+ platform creates an opportunity to work with different types of devices, set up their own scenarios, and provide solutions for different groups of users.

The company was established in its current image in 2013 by Aleksandr Grankin and Alexey Sidorenko. Currently, they share C-suite roles in the company where Aleksandr is mostly responsible for business part, and Alexey for technical. The company is based in Moscow, Russia, although from 2016 all employees work remotely.

GO+ operates mainly on the Russian market. Except the Russia, it also makes some projects for Finnish market. The company has a market share less than 1% globally due to its local presence and competition posed by the big cloud providers such as Microsoft Azure, Amazon, etc., though there is no close competition on the domestic market. The main clients of the company are small and medium enterprises. The size of the company is small, less than 15 people working full-time. The company has project-oriented organizational structure and attracts additional specialists for particular projects.

Although, the GO+ was registered in 2013, it had been run several years earlier. In 2008 Alexey and Aleksandr created a digital agency, at the time when the Internet of Things was an unknown concept. Looking for an innovative approach to develop their business they joined the First Saint-Petersburg business incubator with a project in area of geolocation services. Due to fast development of this technology and evolution of mobile phones, they realized that the smartphones would penetrate the market. The smartphones, having geolocation function, were supposed to generate the data, and the founders of GO+ noticed the opportunity for the app creation that could collect this data. The idea transformed into a service that could track the location of motor vehicles such as tractors and to monitor them. The user could define special zones for vehicles' movements − in case of escaping from the defined zone, the app would send notification to the user and he/she could immediately respond to it. For this project they received their first grant and joined Skolkovo, however, this project did not become successful.

By incremental steps, the company had moved from one solution to another and came up with the IoT solution, striving to create a social network of connected devices. However, after the launch in 2013 the company could not create a viable solution and spent another 3 years working on this project changing the ways of development. In the beginning, the company did not have a specific knowledge in the area of the Internet of Things as well as resources necessary to create the right solution. The created solutions were simply not needed to the market. Eventually, after 3 years of working on the project development, the company provided a viable solution that was not presented on the market and received the funding from Skolkovo. As Alexey mentioned, they finally realized where they were going and what the product they needed to create.

According to the classification provided by Burkitt (2014), the company can be perceived as an Enabler since it builds and maintains critical infrastructure that allows Engagers to create their own connected services. The Engagers who create their own services based on GO+ platform acts as partners of the company with whom they provide the solutions together to the end customers. The company is using licensing revenue model and charges the fee for using its platform.

Nevertheless, the company has not stopped in its development by providing only cloud platform. Eventually, they started acting as Enhancers as well. The company successfully revealed new ways of creating and extracting value from the data, relationships, and insights generated from the IoT activity. In such a way, GO+ provides other companies with solutions that allow clients' companies to enhance their business processes.

Thus, the study based on the case of GO+ company allows to explore what organizational capabilities companies need to develop from the scratch in order to provide successful solutions as GO+ does.

3.2 Main findings and answers to the research questions

The interviews with the experts have shown that consumers and businesses are still slightly aware of what IoT is, although during the last several years we could observe many use cases of technology utilization and easily find them around us. For instance, Rob mentioned the TagIT Smart project where he was an ecosystem manager. This project was aimed on putting tags to everything: products, clothes, etc. These tags can be scanned and either all the participants of the supply chain from the distributors to end customers may receive the necessary information like the product origin, its quality, etc. by scanning these tags. Currently, we can easily find these tags on the products in the supermarkets. GO+ company have used such tags (i.e. QR codes) to understand the business processes in one manufacturing company. Those use cases are just simple examples but they clearly show that even though the rate of technology adoption is quite low, it already encompasses many domains of our life. As Rob fairly mentioned: “Because IoT is very horizontal, it is not just a one thing, it is like air, it is everywhere”.

Undoubtedly, the realization of the IoT projects is impossible without people, and human resources were identified as one of the most valuable resources that company has. The success of the project realization is heavily dependent on the team. The necessary specialists for realization of such projects discovered through this study include CTO, who is in charge of this project and manage the team that performs such projects, developers who develop the necessary software and web systems (backend, frontend), and work with data, engineers who are responsible for the critical systems, and work with hardware such as sensors and so on, testers, designers, server setting specialists (in case of internal cloud development) and IoT advisor. The case of GO+ company clearly shows that not everyone from this list should be always working on a project. The nature of such projects allows to attract specific specialists such as designers and testers only when it is needed and assign them to specific tasks. The most important specialists related to IoT products and services functioning are engineers and developers.

Interestingly, the big role in such projects and in companies implementing IoT play IoT advisers. They can be external as Rob who is not taking the role of someone who bring the product to the market but who make companies ready for the living in IoT world. In other words, this is a someone with specific knowledge related to the IoT who is able to help the company with IoT vision and go through the change.

The value of the employees relies in their knowledge, without which it is impossible to realize such projects. We divided the knowledge resource in two categories, first one is technical and the second one is business. First one includes the knowledge in programming languages such as PHP which is useful among the others for IoT software development. This programming language was successfully used by GO+, however the development of IoT software is not constrained only by this one. Since IoT comprises of different devices, they should be somehow connected, thus, the company should understand different IoT protocols such as MQTT and CoAP. Among the other protocols, MQTT is one of the widely used and GO+ in most cases use this one.

The IoT devices are not standalone objects, they are connected and exchange the information. One of the biggest challenges for companies is their management. It might be not that difficult when their amount is not big, but as Alexey emphasized: “The number of devices at some time achieves 100 and how to split them is not very clear, you need to have groups among devices and answer to the question how to broadcast message to different groups". To solve such problems, companies should have the knowledge in systems engineering and data management.

Another one significant technical knowledge is related to security management. The third-party involvement might bring sufficient damage to the clients and company is responsible for prevention of such situations. Although the GO+ company hasn't faced cyberattacks yet, they have good knowledge and routines that should protect them from undesired interruption. The company track data flows and make safety audits. In case of receiving irrational data, the device is blocked and removed from the conversation with other devices until the specialists would reveal the reason of unusual behavior.

The explored business knowledge include the knowledge in business administration that is integral part of firm management; project management with the knowledge of agile methods (GO+ successfully implemented Scrum); product development which allows company to test hypotheses, develop the customer, and to bring the product to the market; and ecosystem creation that comprises the establishing the business relationships with other IoT related companies (e.g. GO+ provide its platform in a partnership with other IoT-related companies) and work with competitors.

Rob argued that alliances are unavoidable by competitors. As an example, he provided the case of Oil & Gas companies that are aimed to sensorize their equipment but it is very costly, so either companies should have enormous amount of financial resources to develop everything including the cloud on their own or invest in joint development with competitors. Otherwise, Rob claims that these companies will be simply out of the market because the top players such as Microsoft or Amazon will do that first, sensorizing equipment and getting control of the data, which is the most valuable source for the companies. As he claims, the question related to the control of data is the fundamental question for companies realizing the IoT projects. Although it depends on the company itself, Rob thinks that the company should keep the data as close as possible what rise the question about the own cloud development. Looking to the case of GO+ company, we may notice how valuable is the own cloud development – by taking control of the data company could find new ways to utilize this data and created its own solutions. In fact, by having the data coming from partner's clients, the company can simply provide the same solution wiping out these companies from the market. Thus, there is a big threat from big cloud providers to replace your business in case you do not control the data.

The development of own cloud requires tangible resources such as ICT and cloud computing resources (data storage, servers, etc.). This capacity is limited, and the more devices companies connect, the more these resources are needed. Besides, among tangible resources companies need special hardware for IoT such as Raspberry Pi which is general purpose computer and Arduino which is microcontroller board.

The companies also have intangible resources such as software which is developed by the company itself and other software such as Trello or Slack that are project management software. In addition, here we can also emphasize employees' reputation. Alexey mentioned that it is not that easy to find the good specialists for realization of IoT projects, they should have good reputation so company may be sure that such specialists will suits well. On the other hand, the company also should have the good reputation to attract the talents. In case of GO+ company, the recruitment of talents is based on references provided by employees and known people. The company typically search for the people who may bring something new to the company and share their experience. For instance, some engineers previously worked on the construction of one well known aircraft.

Except the resources that are included in Appendix 4, we identified the numerous of routines (Appendix 5) that are present in the companies realizing IoT projects. The literature does not provide the classification of routines and, in fact, they might be totally different depending by the company. Nevertheless, there is a set of identified routines that is difficult to avoid when it comes to realization of IoT projects. These routines were assigned to the two main categories: project routines that are specific for the projects and organizational that are attributable to companies as a whole and has an impact on IoT projects realization. Starting with the typical project routines that can be identified not only in IoT related projects but also in projects of other kind since they are necessary for every project realization, we would emphasize project scenarios identification which is important for planning the project and considering the factors that might have an impact on its execution; dealing with changing requirements – Alexey mentioned that sometimes clients change their requirements during the project realization, and, hence, company need to attract more resources; weekly review which allows to track the team progress every week, identify the flaws and plan the following steps, such a routine is basically part of the Scrum process.

The company pays particular attention to identification of technical requirements feasibility because sometimes clients require something that is impossible to perform. If the company starts the project with unclear requirements, it simply will spend resources on what should not have been done at all.

Many of the routines identified are related to communication. There is a constant communication between CTO, engineers' and developers' team leads because their actions are dependent on each other. In the beginning of the day, they have a short call to discuss the current work and important issues to be solved. Alexey emphasizes that it is crucial for the company to establish the atmosphere of mutual trust and understanding because if the employees do not understand each other, it significantly decreases the efficiency of the work and increase the negative attitude towards the others. Typically, engineers and developers communicate directly, and this is how relationships should be actually built. Alexey argues that he used to control the communication and was heavily engaged in micromanagement but for a while he stopped to do that because the team works well without management interruptions, and only if there are some serious questions, he listens to both sides and make a balanced decisions that are discussed together with employees.

Since the data is of the greatest value for the companies realizing IoT projects, data management routines are fundamental for the company. These routines include data accumulation, data processing, data control, data analysis, data tracking, data sharing.

There are also different systems management routines such as systems setting, systems upgrading, hardware maintenance and security audit. In addition, we emphasized device management routines comprised of broadcasting message to the group of things, sensors plugging in, identification of protocols for communication between devices, managing increase of connected devices and devices blocking in case of interruptions. By having such routines together, the company ensures that everything works as it is supposed to work.

To deliver the valuable product to the clients, company has product development routines testing the hypotheses, experimenting, evaluating the market, its trends and developing the customer. The company identifies and creates opportunities which further transform in new projects and solutions for the clients. The value provided by the collection and analysis of the data serves as the basis for such opportunities identification.

As it is fairly mentioned by Rob, the realization of IoT project brings in the change to the companies. He argues that most businesses are mediocre and built to be inefficient. The data generated by IoT reveals such pain points and businesses must restructure and optimize their processes. This is clearly evident from what GO+ is doing, they define business contexts to understand how business processes flow in the company. For instance, the project performed on the paper mill revealed that by sticking QR codes to the paper rolls, the company can perform its processes 12 times faster than without IoT when the participants of supply chain process have to fill many different forms and collaborate with different people during this process. The managers of such companies are simply cannot measure such processes without the IoT utilization since the participants of this processes are assumed to act according to the rules written in different manuals, although in reality they perform these processes differently.

Importantly, the company forces the continuous learning and knowledge sharing routines. For instance, the company didn't have knowledge and competencies in big data and network communication technology. By attracting the right specialists, they could learn new things and implement them in the work. Alexey emphasized that they are still learning something new. Rob also made a special attention to the knowledge sharing and continuous learning: "The IoT shows that a lot of things need to change in the company and whoever installs IoT system will be out of business by that system in 5-10 years. If the mindset of owners, middle management and other employees doesn't change, and they won't learn new things to go through this change, they'll be broke". With the change that bring IoT, people in the company also should change and learn new things.

Based on the findings about resources and routines that are integral part of organizational capabilities as well as on direct information about organizational capabilities provided by interviewees, we could come up with several organizational capabilities that are required for realization of IoT projects (Appendix 6). Based on Teece's framework, they were split into two main categories: ordinary and dynamic capabilities. The classification of dynamic capabilities is based on Madsen's (2010) taxonomy. As a result, we developed the model consisted of organizational capabilities, routines and resources that are required for realization of IoT projects.

The model consists of 6 ordinary capabilities that are necessary for successful functioning of developed IoT solutions. As we observed during the study, the wise management of IoT devices is the core element of IoT systems. Without the knowledge of how to manage them, it is impossible to create the system of connected devices, however this capability was not included in the study propositions due to its absence in existing literature which is quite illogical.

While the management of IoT devices is only one part of creating the working systems, the systems should be engineered in such a way that the whole system with the constant increase of IoT connected devices could perform in a stable way. That brings us to the systems engineering capability which was mentioned by Porter and Heppelmann (2014) and confirmed in this study. These systems should be protected from cyberattacks, so that companies can be safe from any interruptions. The security-related capabilities are also confirmed by this study.

The company should be able to carefully manage its data since the data creates the value for companies realizing IoT projects. The companies do not necessarily should have the own cloud and, hence, cloud computing capability. Nevertheless, we decided to include the cloud computing capability to this framework since the ownership of control can be achieved only if the company keeps it internally. This capability also was not identified by other studies and our finding extend the existent theory.

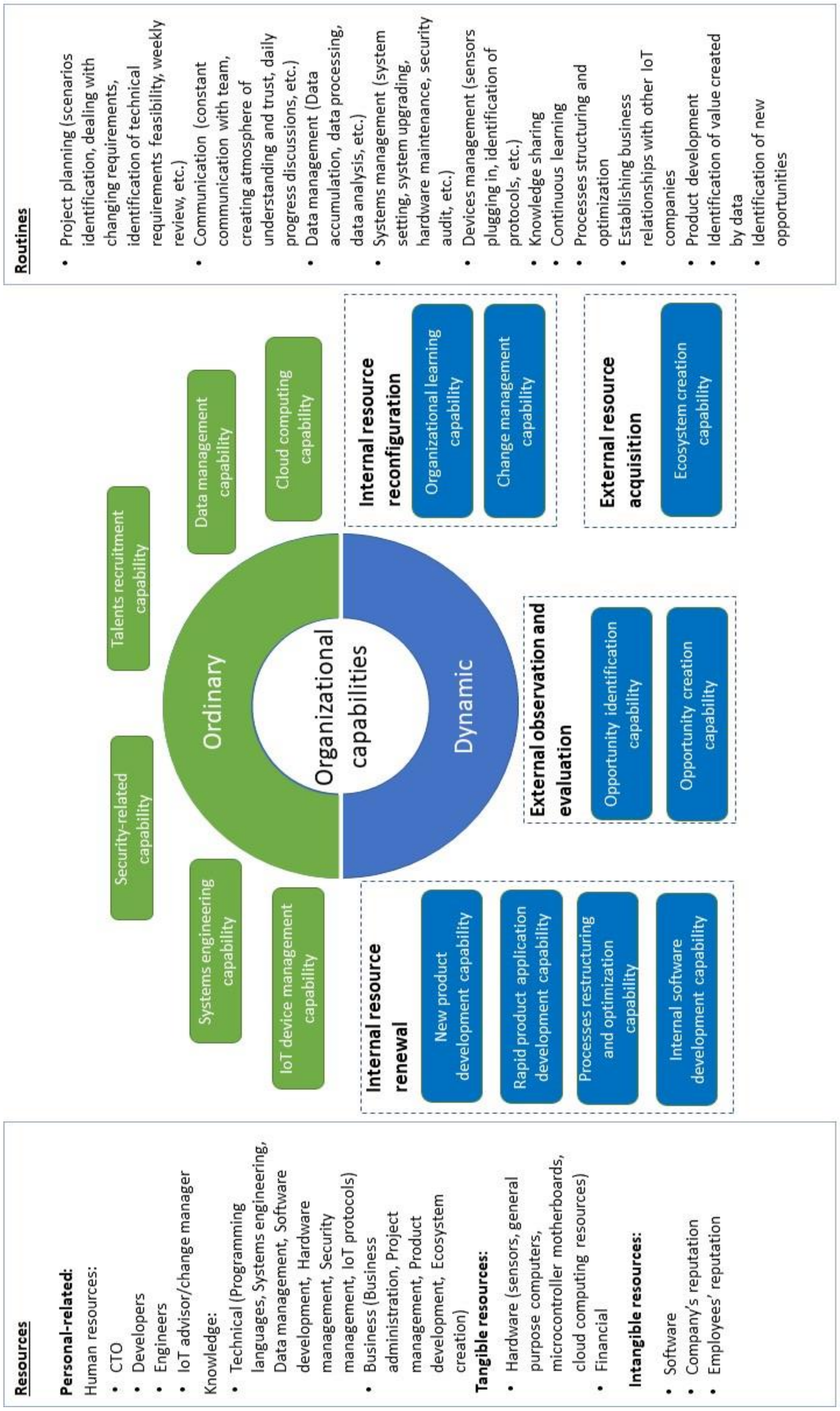

Figure 6. The developed model of organizational capabilities required for realization of IoT projects

The company should be able to carefully manage its data since the data creates the value for companies realizing IoT projects. The companies do not necessarily should have the own cloud and, hence, cloud computing capability. Nevertheless, we decided to include the cloud computing capability to this framework since the ownership of control can be achieved only if the company keeps it internally. This capability also was not identified by other studies and our finding extend the existent theory.

Undoubtedly, the company should be able to manage its data since IoT is about data created, data sent, and data analyzed which creates the value for firm. In the literature review we identified capabilities such as ability to manage and analyze huge quantities of data (Burkitt, 2014), analytical capabilities allowing companies to take advantage of the data generated (Capgemini, 2018) and data analytics (Porter & Heppelmann, 2014). These capabilities were confirmed in this study and during the coding process merged to one category – data management.

For successful management of devices and data, companies need special software. Since the IoT solutions are constantly updated and require more and more iterations, companies need to have the internal software development capabilities. This capability was mentioned by Porter & Heppelman (2014) and confirmed in our study.

We also confirmed the human capabilities such as the employment of talented people with external relationship experience, in this paper we identified it as talent recruitment capability.

Except the ordinary capabilities, the model consists of 9 dynamic capabilities that are divided in 4 groups. It is evident from the case of GO+ company that having only ordinary capabilities is not enough for successful realization of IoT projects. As it was emphasized in the literature review, the dynamic capabilities are in their essence change capabilities and the study showed that IoT brings the big change to the companies. Despite of the reason why a company utilizes IoT – increasing operational efficiency, creating new products, achieving competitive advantage, etc., we can argue that for successfully realize the IoT projects, the company needs to change internally and this is impossible without building dynamic capabilities. As it was fairly mentioned by Karimi & Walter, they are needed to disruptive technological shifts. Thus, crucially, the company should develop change management capability since IoT has a huge impact on how businesses operate. The current literature has lacked to identify such capability and, as a result, was not included in study propositions.

Among dynamic capabilities, our findings from the case study has revealed selective and search capabilities mentioned by Isada, F., & Isada, Y. (2019) which are characterized as ecosystem creation capability. Rob paid special attention to it: “You can survive only in large ecosystem, that’s why you need to find right partners". The GO+ company has successfully accomplished this task, their ability to find the right partners allowed to provide their solutions together with these partners and on top of these partnerships create additional products. The ecosystem creation also comprises the ability to integrate diverse portfolio of services identified by Burkitt (2014).

Although Rob mentioned that the Bosch company to an extent successful in IoT projects due to the pressure absence from the shareholders, we agree with Porter and Heppelman (2014) that companies should have capability of rapid product application. As Alexey fairly mentioned, the market conditions might change very fast and if you develop your IoT solution slow, it might become obsolete. It is confirmed by Rob: "IoT product always change with new iteration, the business cannot more to be built around static products". Even though he believes that there should not be pressure on the team developing IoT solutions since it might take time, the firm should be able to develop the product as fast as possible.

We also confirmed the second proposition about the resources needed. All of them are utilized by GO+ company. Moreover, we identified much more resources during the study compared to the literature which are necessary for realization of IoT projects. These resources are related to the knowledge domain. While literature provides information about resources related to systems engineering, software development, hardware development, etc., it lacks to mention not less important knowledge in project management, business administration, product development and ecosystem creation without which the IoT project are more likely to be failed.

As we can see, the capabilities included to the model confirm all the findings by different authors. The developed model also includes routines, on the basis of which the organizational capabilities have been developed. Moreover, except the verification of organizational capabilities identified in current literature, we extended the theory by explored dynamic capabilities which are reflected in the model.

Overall, we can conclude that by developing the organizational capabilities emphasized in this model and having these resources in place, companies might significantly increase their chances to successfully realize IoT projects.

3.3 Theoretical contribution and managerial implications

The main theoretical contribution of this study resides in the developed model of organizational capabilities required for realization of IoT projects. This model consists of 6 ordinary and 9 dynamic capabilities which were divided in 4 categories based on the existing literature. In this study we could prove the findings of previous research related to the organizational capabilities required for realization of IoT project and extend the current knowledge by the exploration of another capabilities, resources and routines.

From managerial perspective the conducted study is beneficial since it provides companies with a checklist of what is needed before the IoT project can be run. The main focus of companies should be paid to the organizational capabilities. By looking at each organizational capability the company should answer the questions: “Do we have necessary resources that allow us to develop this capability?” and “Are there necessary routines for the development of this capability?”. The mentioned resources and routines in the model serve as prompts that should allow companies to answer on these questions. Moreover, the advantage of the model is that it encompasses capabilities required for all firms whatever it represents Enablers, Engagers or Enhancers. Thus, by focusing on the capabilities represented in this model, companies may avoid the pitfalls related to the implementation of IoT and enhance their business by utilization of emerging technology.

3.4 Limitations and suggestions for further research

There are several limitations related to this study. First, the chosen method, single case study, increases concerns about the replicability of the analysis. In fact, by testing the organizational capabilities identified from the literature review, we could replicate the results and confirm the previous findings, what cannot be said about the resources and routines since they were almost ignored by researchers.

Secondly, we identified additional organizational capabilities that were not covered by the current literature. These capabilities were not replicated to other cases what might appeal to the question whether they will be confirmed in the other firms. Nevertheless, we may argue that the results are appropriate and can be applicable to other firms taking into an account the sources of information.

Finally, the limitation of this study consists in the relationships between grouping of capabilities, resources and routines and their relations to each other. During this study, we cautiously related different categories to each other based on provided in literature taxonomies and own expertise. However, taking into an account the modest existent knowledge in the area of organizational capabilities, especially related to new technologies utilization, we can see that the clear line between ordinary and dynamic capabilities have not been identified what allows to group capabilities in different ways.

Thus, the findings of this study should serve as a grounded theory for further quantitative research where the relationships between identified resources, routines and their importance for the development of necessary organizational capabilities can be explored. The quantitative study can be also useful for identification of relationships between organizational capabilities included in the model and its impact on IoT projects realization.

3.5 Conclusion

In the last several years, we could observe how the IoT has passed the peak of inflated expectations and get closer to the trough of disillusionment. The great interest in technology was blighted by the inability to deliver its implementation. Indeed, the enormous number of 75% of failed projects has discouraged many interested companies to run IoT projects. Nevertheless, IoT proved its value for the business, and its adoption by firms is mostly questioned only by the time when firms will be ready. As we identified during the literature review, the biggest barrier of IoT adoption lays in the absence of necessary organizational capabilities.

In the current research the organizational capabilities were investigated in the context of IoT to understand what are the necessary organizational capabilities, accompanying resources and routines firms need to have in order to overcome the barriers in realization of IoT projects. This research was based on the case study of GO+ company which successfully realized the IoT projects and shared its experience with us. The company not only could develop initial IoT solution – IoT platform, but also extended its IoT services and now represents not only Enablers but also Enhancers. Moreover, the company does not stop in its development, exploring the full potential of IoT and creating the meaningful solutions.

During this study, we also had an opportunity to talk with the head of IoT Council in Europe, who is recognized as one of the top IoT influencers in the world. The expertise of Rob, who has a big experience working on IoT projects together with companies that successfully adopted IoT such as Siemens, allowed us to extend the current theory and elicit the information which is highly valuable for the companies starting their IoT journey.

The aim of the paper was to create a theory comprised of organizational capabilities required for realization of IoT projects. The proposed model consists of 15 organizational capabilities including 6 ordinary and 9 dynamic which the companies should have for the realization of IoT projects. This model is becoming more valuable taking the account the current situation in the world. As it was mentioned in recent McKinsey article, the IoT can, on the one hand, ensure the employee safety and security by enabling remote employee collaboration, workforce tracking and vision-based control systems, and, on the other hand, to help firm in crisis times by lowering costs, improving its flexibility, and helping to achieve stable revenue (McKinsey, 2020). However, they emphasize that only few business leaders are considering this opportunity now due to the failure risks associated with the technology implementation.

Thus, the findings of the current research can help companies to lower their risks in realization of IoT projects and reap the benefits of the new technology.

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Appendices

Appendix 1. 11 capabilities that well-managed companies tend to have (Smallwood & Ulrich, 2004)

Capability	Description
Talent	The organization is good in attraction, development and retaining competent and committed employees.
Speed	The organization is good at making crucial changes happen fast
Shard mindset/brand identity	The organization is good at bringing the positive and consistent images of and experiences with firm for its customers and employees
Accountability	The organization is good at obtaining high performance from its workers
Collaboration	The organization is good at working across boundaries to ensure both efficiency and leverage
Learning	The organization is good at generating and generalizing ideas with impact
Leadership	The organization is good at embedding leaders throughout the firm
Customer connectivity	The organization is good at building enduring relationships of trust with targeted customers
Strategic unity	The organization is good at articulating and sharing a strategic point of view
Innovation	The organization is well performing at doing something in both content and process
Efficiency	The organization is good at managing its costs

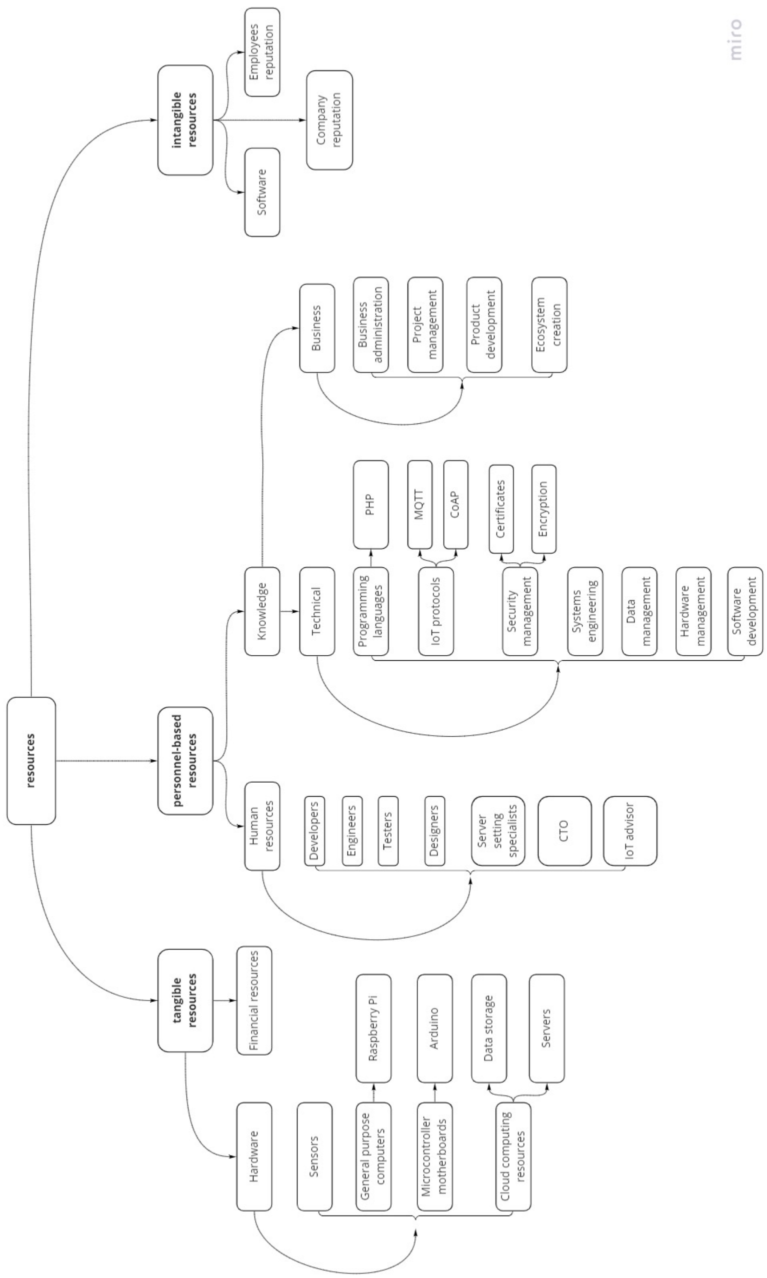
Appendix 2. Interview questions (Alexey Sidorenko)

1. What is your role in the company?
2. How did you come up with the idea of your product?
3. Who are your clients?
4. Could you tell about the market you're operating in? How are you developing there, who are your main competitors?
5. Could you describe your organizational structure?
6. How big is your team?
7. How the work is organized and team is managed?
8. How the decisions are made in your company?
9. Could you describe the communication between different roles in the company?
10. Could you describe a typical day of a company?
11. Could you describe how you evaluate team's progress? What techniques do you use?
12. How do you monitor the performance of an employee to understand in time where can be mistakes and how you can fix them?
13. How difficult for you to attract the talents?
14. What skills and knowledge are necessary for GO+ employees to successfully make their job done?
15. What hard skills of developers and engineers would you emphasize?
16. What additional knowledge have you acquired during the realization of your project?
17. What resources your company need for the realization of projects?
18. Do you find it critical for your company to manage and analyze big data?
19. What difficulties have you experienced during realization of projects?
20. Could you describe how do you solve security-related issues?
21. How often do you face interruptions?

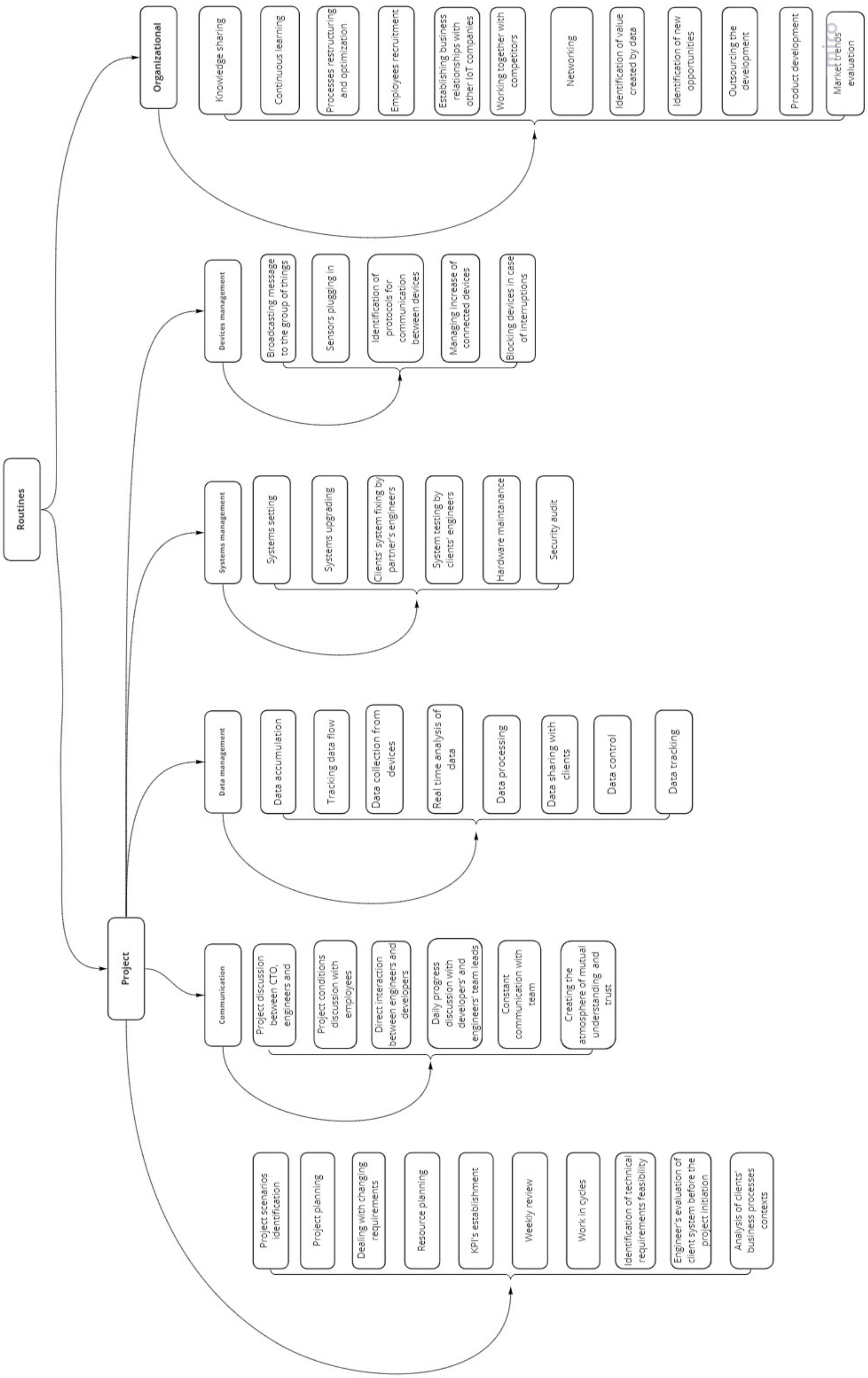
Appendix 3. Interview questions (Rob van Krannenburg)

1. Could you explain how do you help companies during the realization of IoT projects?
2. Do you think that company such as GO+ that want to utilize this technology should develop everything inside the company or they can delegate something to the side company?
3. What employees should be in the company for IoT projects realization?
4. How do you think, how company should be run to be able to utilize IoT?
5. What resources should company has to realize IoT projects?
6. What routines should company has to realize IoT projects?
7. What knowledge should company has?
8. What difficulties do you see for companies when they decide to realize IoT projects?
9. Do you think that it is crucial for the company to have capabilities in data management and big data analytics?

Appendix 4. Coding: Resources



Appendix 5. Coding: Routines



Appendix 6. Coding: Organizational capabilities