

IT Capability Review

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Abstract. *IT Capability has been studied for many years. The aim of this paper is to investigate how IT Capability has been defined, which are its basic factors and whether there are methods for the development of IT Capability. The research is based on the existing literature, models and frameworks. It shows that IT Capability is associated with competencies (skills and knowledge) and IT resource (infrastructure). The development of IT Capability is possible by taking into account the maturity level. The research shows the need for linking IT Capability with business capabilities as well as the development and assessment of maturity levels.*

Keywords. IT Capability, Competence, IT infrastructure resource, Capability Maturity

1 Introduction

The current business of organizations can be described as internationalized, interconnected, surrounded by a variety of services (e.g. Google Apps, Apple Store, Ovi Store, Microsoft Office 365, Windows Live, Kindle eBooks), technological solutions (iPad, Tablet, Cloud, Kindle), and affected by different chaotic events in the environment and the world (the crisis, new competition).

The application of IT within an organization can be traced through several stages. The initial phase refers to the support of administrative actions in business, and is provided by automation, control and communication through IT. This stage can be seen in the organizations that have accounting supported by IT and internal and external communication (e-mail, web). The extension of this stage can be traced through the creation of IT solutions that enable automation and control a wider range of business processes (e.g. manufacturing, banking). The most important phase of IT adoption within the

enterprise is realized through a transformational stage. At this stage, the IT influences, changes and provides new forms of business, becomes a strategic partner within the organization, and is focused on generating value.

Apple has the service iTunes. If we look at what Apple has done through iTunes, then we can see that it is based on the construction, integration, reconfiguration and connection of different resources: Internet, shops, software support for digital rights, content distribution device (iPod, iPad), and a number of related activities (innovation, quality, design). It has created an effective business model which has ensured the continuity of outcomes, competitiveness and created value.

The contribution of Apple in achieving this success can be found in the IT Capability. IT Capability, according to Henderson and Vankatraman [9] refers to the factors upon which the organizations differ in the effectiveness of using IT in business transformation. Research papers [7], [12], [19] show that IT Capability is important in achieving positive business impacts, and the research [16] shows that it cannot be purchased on the market as a finished product, but must be developed over time.

Given the importance of IT in creating and achieving business value and outcomes, the management is challenged how to create IT Capability in current conditions as well as how to link them to business and organizational capability in order to create business effect and value.

In this paper we start out from the following research questions: How is IT Capability defined and which are the basic characteristics of IT Capability? What framework (methods) does exist for the development and establishment of IT Capability?

2 Research framework

In order to achieve the objectives of this study, we used the methodological procedure proposed by Webster and Watson [21].

The time frame used for the research is the period from 2004 to 2011. To ensure that we have taken into account relevant research papers, we first analyzed the research papers in leading journals in the field of information systems. To determine the leading journals, we took the classification of the Association for Information System. According to this classification, the leading journals in this field are: MIS Quarterly, Information System Research, Communications of the ACM, Management Science and Journal of Management Information Systems.

The next step in gathering relevant research was to search the database of the journal Science Direct, Scopus, ACM Digital Library and AIS. Searching in these databases was done with logical expressions ("Information Technology", "IT") AND ("capability" OR "capabilities"). In order to include Croatian research, we searched the database of journals Hrčak, and the Journal of Information System, Journal of Computing and Information Technology.

The papers were analyzed with focus on understanding and determining which phenomena are present in this area. Hevner and Chatterjee [10] describe a phenomenon as a set of behaviors of an entity that are in the interest of researchers and communities, and is understood as knowledge that allows predicting the behavior of certain aspects of the phenomena. The necessity to study the phenomena is indicated by Carlie and Christensen [2], who define them with the term *constructs*. The constructs are described as an abstraction from many details, which help us in understanding and visualization.

In order to make a comprehensive study, we took into account models and frameworks. A model provides a schematic description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics. A framework directs us to the fundamental structure and a set of assumptions, concepts, values, and practices that constitutes a way of viewing reality.

3 Analysis

3.1 Conceptual and terminological definition

Through a variety of perspectives and relations to the present day, a series of studies has been conducted on the topic of IT Capability. Research shows that there is no single definition of IT Capability.

IT Capability, according to Wilcocks et al. [22, p. 29] focuses on the skills and knowledge, and is defined as "*a distinctive set of human resources-based skills, orientations, attitudes, motivations and behaviors that have the potential, in suitable contexts, to contribute to achieving specific activities and influencing business performance.*"

Another aspect is given by Stoel and Muhann [20] who include IT resources when defining IT Capability, and describe it as a complex set of IT resources, skills and knowledge generated within the business process, which allow enterprises to coordinate activities and to use IT resources to achieve the desired results. Bharadwaj is in line with this and he describes IT Capability in three categories [24]: the IT infrastructure, IT human resources and IT intangible assets. Viewing what IT Capability is, Ross et al. [18] determined that it refers to highly competent human resources, technological base and a strong correlation between IT and business management.

Peppard and Ward [17] provide a different view of what the Capability is, explaining that it is the set of skills and knowledge related to the competencies upon which individual organizations deploy and utilize resource and organizational process to achieve the effect. According to them Capability denotes the strategic application of competencies in achieving organizational goals.

Considering the previous description, the IT Capability can be described as a bond of competencies (skills and knowledge) and IT resources (infrastructure) which is created by a particular organization and is implemented through activities to achieve business objectives.

3.1.2 Competencies

Competencies can be described as a set of knowledge and skills, abilities which allow a person to do business activities or to solve various situations.

Human resources should have a combination of technical capability [8], [3], [13]; business

management capability [8], [3], [13] as well as behavioral capability [18].

Behavioral capability encompasses the interpersonal and management skills of IT personnel to interact with and manage others.

Technical capability results from the technical knowledge and skills associated with the creation, access, acceptance, and manage technologies.

In analyzing what is important in technical capability, Madanmohan et al. [14] emphasize the importance of technological transfer (internal, external), which is realized through: Investment Capabilities, Operational Capability and Learning Capabilities. Investment Capabilities are associated with the skills and information necessary for identifying feasible investment projects, for identifying and purchasing technology, for development, engineering and maintenance of the technological projects. Operational Capability refers to the skills and information required for acceptance, establishing functionality, repairing and maintenance of technology in order to increase production and efficiency. Learning Capability refers to skills and information needed for generating the technical and organizational changes, and managing them.

Business management capability, according to Kohli and Grover [11], indicates understanding of the market (environment), the organizational context and implementing of business practices in order to achieve strategic and operational goals. Stoel and Muhana [20] separate these capabilities into internal and external. External cover the bundles of IT-related resources, skills and knowledge that help businesses to detect and respond to market changes and changing needs of consumers and suppliers. Internal capabilities are bundles of IT-related resources, skills and accumulated knowledge that help the firm to offer reliable products and services and minimize overhead costs.

A further elaboration of business management capability is given by Lin and Hsia [13], who focus on the ability to recognize market opportunities, generate new values, business model transformation and absorption of new knowledge and skills, which include: fostering business agility and market responsiveness, identifying customer value proposition, reinventing established business models, and developing enterprise absorptive capacity.

Fostering business agility is focused on the timely identification of market changes and business opportunities, as well as looking at the possible opportunities in order to take up the

business innovation. Market responsiveness is linked to the ability to observe changes in technology, market and customer needs by continuous analyzing the business environment. Customer value proposition assumes that the new business model requires a clear definition of business value to the customer. It represents a firm's routines in assessing, understanding, and communicating customer value signals in the markets. Reinvention implies that a firm can deploy solutions with proper inputs, match them with business opportunities, deliver innovative products and services for customer value creation, design and profit formulas for execution, and commit to reconfiguring its key resources and processes. This capability comprises the routines for change management, organizational commitment, and a culture that embraces business transformation. Enterprise absorptive capacity refers to the ability to continuously acquire, adopt, assimilate and exploit e-business innovations.

Further expansion of competencies comprising and expanding previously mentioned behavioral, technical and business capability can be seen in framework *Nine Core IS Capabilities*, defined by Wilcocks and Fenny.

They proceed from three basic elements: Business and IT vision, Design of IT architecture and IT Delivery whose overlapping creates an area for Governance. The focus in this framework lies in areas of overlapping between the elements. Overlaps define competencies. The following 9 competencies are defined [22]: Leadership (integration of IT with business objectives and activities, and IT has to provide value), Business systems thinking (IT technological capabilities are provided for each process), Relationship building (dialogue between business users and IT specialists is established), Architecture planning (IT platform which enables functionality in relation to future requirements is established), Making technology work (quickly resolve IT problems), Informed buying (analysis of foreign markets), Contract facilitation (providing that the problems and conflicts are solvable for long-term relationships), Contract monitoring (determining how successful the existing services are with respect to established standards) Vendor development (identifying which added value can be achieved through external suppliers).

Comprehensive view of the competencies, as well as their linking in organization is provided with framework *IS competencies*, defined by Peppard and Ward in 2004. Competencies are given in 6 basic domains [17]: strategy, defining

the IS contribution, defining the IT Capability, exploitation, delivering solutions, supply and 26 sub-domains of competencies.

Through the formulation of strategy it is necessary to ensure competencies which enable the formulation of business strategies, incorporate the potential of new technology, management and investment governance. The IS contribution domain requires competencies associated with the definition of the IT portfolio, IT alignment, business process design based on best business practices, and taking research activity for innovation. The IT Capability domain is related to translate the business strategy into long term information architectures, technology and resourcing plans that enable the implementation of the strategy (i.e. the IT strategy). Competencies within the Exploitation domain are related to identification, monitoring, measuring, implementation and evaluation of the benefits of IT investments. Deliver Solutions and Supply domains are linked to the competencies that are required for IT management at the operational level, and defining success criteria.

Preliminary considerations and framework not indicated how an organization acquires initial (or new) competencies. Through technology transfer it can be ensured for organizations to achieve initial (or new) knowledge and skills to help them in developing and applying IT. Technology transfer allow us to organization such as: USAID (United States Agency for international Development), GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), Microsoft, CISCO, Intel, Hewlett Packard etc. Most of the efforts/projects have been developed as public-private partnership between development organizations and private partners. Their efforts can be summarized in four pillars:

- Education / Knowledge Transfer Pillar
- Information Pillar
- Networking Pillar
- Solution Accelerator Pillar

Education / Knowledge Transfer Pillar provides competence development (at lower cost) in 3 areas: business management, technology knowledge and soft skills. This pillar has been implemented as a complement to the formal education in an innovative way that is fostering team work, project management and problem solving approach, rather than learning facts and figures.

Information Pillar provides information about available resources, both business and technology wise. Through this pillar information such as

market information and outsourcing information are made available.

Networking Pillar enables communication and collaboration between IT experts, business professionals, organizations, professional organizations, IT vendors, governments, academic institutions etc. But most important is that this pillar enables partnering and collaboration across different industries/sectors and within IT sector.

Solution Accelerator Pillar provides resources in the form of development and testing labs, certification facilities and possibility to implement proof-of-concept projects and demonstration facilities, all of that through hands-on engagement.

3.1.3 IT infrastructure resources

IT infrastructure resources are a set of IT resources that are the basis for current and future business systems. The traditional definition of IT infrastructure resources is associated with a set of technological resources (e.g. hardware, operating systems), networks, telecommunication technologies, data and core applications. The extension of the definition is given by QI et al. [16]; it consists of 4 components:

- Shared technological components - include hardware, software, networks, database, communication. This is the foundation of IT infrastructure;
- IT Human Resources - composed of human and organizational knowledge, skills, standards, experience, etc., which translate IT technological components into a reliable set of understandable, shared IT services that business people can understand;
- Shared IT services - include network service, system management, security management, provision of an extranet capability, or management of large scale data processing. The orientation is to get effective IT services based on IT components and IT human resources;
- Shared IT applications - these components are relatively stable IT applications, which directly support business processes, such as human resource management, budgeting, accounting, purchasing, enterprise resource planning and other.

Categorization infrastructure IT Capability is given by [16]: sharing capability, service capability and flexibility. Sharing capability represents the efficiency of the IT infrastructure in providing interlinkage homogenous service to the

customers within and outside the organisation. The description is given through "reach" and "range". "Reach" refers to locations that can be connected via the infrastructure from local sites to international sites. Range determines the level of functionality (of services) that is shared through each level obtained through "reach". Service capability is associated with the identification of business requirements, are directed to the efficiency of existing resources. Flexibility denotes the capability to adapt the IT infrastructure in relation to the changing environment. Flexibility is categorized as technical and managerial flexibility.

Flexibility is taken as the key IT infrastructure capability [5]. CIOs often rank ability to develop an efficient and flexible IT infrastructure as their most important priority in helping their organization achieve better performance and innovation. If we look at how Flexibility is defined at the organizational level, then it is described as the degree to which an organization possesses a variety of actual and potential procedures, and the rapidity by which it can implement these procedures to increase the control capability of the management and improve the controllability of the organization over its environment [6]. Flexibility allows firms to create innovation at lower costs compared to competitors, because of the adaptability of systems and business processes to changing conditions. The importance of this capability at the level of IT resources can be found in the capability of hardware, software, network technology; that is of the whole portfolio of capability system which may affect the extension of functionality and capacity of IT resources.

Flexible IT infrastructure includes the generation and dissemination of information across organizational units, and includes [1]: *scalability* (IT resources must have a capacity that allows you to work with the increased volume of information without requests for additional resources); *compatibility* (retention of existing IT resources when adding new) and *modularity* (ability to reconfigure the IT resource).

The example of IT Capability IT resources (infrastructure), in this context can be seen whit Cloud Computing. NIST [15] defines Cloud Computing as: "*.. is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal*

management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models."

This is compatible with 3 out of 4 components that were defined by research [16]: Shared technological components (cloud computing: Resource pooling, Broad network access, Rapid elasticity), Shared IT services (cloud computing: On-demand self-service, Measured service), Shared IT applications (cloud computing: Software as a Service).

3.2 Development and assessment of IT Capability

IT Capability within the organization makes sense if it contributes to the achievement of business capability and business objectives. The model indicating the position of IT Capability is the *Strategic Alignment Model* by Peppard and Ward [17], which consists of these areas: Business strategy, IT strategy, IT operations / services and Business Operations. IT Capability has influence on all areas.

Organizational effects are the direct result of business operations (e.g. customer service - iTunes). Weaknesses in the field of IT Capability have an impact on organizational performance. The model does not show how to use IT resources and competencies to achieve the effects, or which evaluation procedures could be used.

Creating the IT Capability is a process that must be formalized, managed and controlled. Linking IT Capability with development and achieving business objectives is given by Wilcocks and Fenny [23]. They consider IT Capability through the levels of maturity (stages), with a focus on competencies. They identify three stages: *delivery*, *reorientation* and *reorganization*. The first stage in which competencies appear is the delivery phase. It includes making technology work competence, technical architecture and contract facilitation. Through the phase of reorientation they suggest focus of IT on operations, and the following competencies are included: relationship building, business systems thinking, informed buying and contract monitoring. The full scope of competencies is necessary within the reorganization phase, where IT plays the role of a business innovator. The disadvantage of their model is the omission of the initial stages, not

taking into account the full range of competencies and the absence IT infrastructure capability.

A further extension of applying levels of maturity in the development and establishment of IT Capability can be seen within the Framework of IT Capability Maturity Framework (IT-CMF). The framework is focused on achieving Business Value by using IT. It is defined by Martin Curley and consists of four basic domains [4]: *managing IT Budget*, *managing IT Capability*, *Managing IT for Business Value*, and *managing IT like a Business*. The importance of this framework is taking maturity levels in achieving IT Capability, which allows us to determine the variance between business requirements, currently achieved level of IT Capability and business value realization. IT Capability is realized through 5 levels of maturity. The first level is called *Unmanaged*, there is no systematic development of IT. The second level is called *Technology Supplier*, where IT is considered as a cost center with a focus on reducing costs. The third level is called the *Technical Expert* within which IT provides services together with the control of performance and cost. IT is a source of technical expertise. The fourth level is called *Strategic business partner* where IT leadership is integrated in business leadership. IT provides solutions which provide value to individual business areas. The fifth level is called *Strategic core competencies* in which steady stream of IT solutions provides competitive advantage and IT is recognized as a differentiating core competency.

4 Conclusion and Further Research

Based on our research and experience in working within IT field, the first step in evaluating IT Capability is to provide the appropriate context. For example, different countries and their business and social environment provide different context and environment that influences the evaluation of IT Capability. Other factor that needs to be included in creating the context is the dimension of time.

As we already mentioned, IT Capability can be described using combination of competencies (knowledge and skill) and IT resources (primarily infrastructure).

There are several different ways how necessary competencies for IT Capability can be developed, and this is most often connected with the need to innovate. People and teams involved

in the process need to have technical, as well as business management capabilities combined with excellent soft skills.

Everyone can agree that IT Capability is very important for all organizations, including the companies, especially in the time of crises like the one that stroke 2008-2012. One way of achieving the IT Capability is to develop competencies of the organization. The other is to invest in IT resources (primary infrastructure).

Based on our research, it is very hard to provide objective IT Capability assessment. Although there are models defining what to measure it is not clear how to provide objective metrics. Our intention is to continue research in that field, along with investigating practical examples of IT Capability implementation and IT Capability Maturity Level assessment.

5 References

- [1] Bhatt G., Emdad A., Roberts N., Grover V.: *Building and leveraging information in dynamic environments: The role of IT infrastructure flexibility as enabler of organizational responsiveness and competitive advantage*; Information & Management, Volume 47, Issue 7-8, pp. 341-349, 2010
- [2] Carlie P. R., Christensen C. M.: *The Cycles of Theory Building in Management Research, version 5.0*, Harvard Business School Working Knowledge, accessed: 21. 03. 2011., available on: <http://www.hbs.edu/research/pdf/05-057.pdf>
- [3] Chen J., Zhao M.: *Study on the Analysis of Information Technology Capability of Third-Party Logistics Firms and its Constructing*, u 2009 International Conference on Information Management, Innovation Management and Industrial Engineering iciii, Vol. 1, pp. 424-427, 2009
- [4] Curley M.: *Introducing an IT Capability Maturity Framework*; u Enterprise Information Systems Lecture Notes in Business Information Processing, Vol. 12, Issue: 1., pp. 63-78, 2009
- [5] Dai Q., Kauffman R. J., March S.: *Valuing information technology infrastructures: a growth options approach*, Information technology and management; Vol.: 8, Issue.1, pp. 1-17, 2007
- [6] De Leeuw A.C.J., Volberda H.W.: *On the concept of flexibility: a dual control perspective*, Vol. 24, Issue 2, pp. 121-139, 1996
- [7] Dehning B., Richardson V. J., Startopoulos T.: *Information technology investments and firm value*, Information & Management, Vol. 42, pp. 989-1008, 2005
- [8] Fink L.: *How do IT capabilities create strategic value? Toward greater integration of insights from*

- reductionistic and holistic approaches*, European Journal of Information Systems, Vol. 20, pp. 16-33, 2011
- [9] Henderson J., Venkatraman N.: *Strategic Alignment: A model for organizational transformation via Information Technology*; CISR WP No. 217, Sloan WP No. 3223-90; Center for Information Systems Research, MIT, Massachusetts, 1990
- [10] Hevner A., Chatterjee S.: *Design Research in Information Systems: Theory and Practice*; Springer, New York, 2010
- [11] Kohli R., Grover V.: *Business Value of IT: An Essay on Expanding Research Directions to Keep up with the Times*; Journal of the Association for Information systems; Vol. 9, No. 1, str. 23-39, 2008.
- [12] Lin B-W.: *Information technology capability and value creation: Evidence from the US banking industry*, Technology in Society, vol. 29, pp. 93-106, 2007
- [13] Lin L.-M., Hsia T.-L.: *Core capabilities for practitioners in achieving e-business innovation*; Computers in Human Behavior, Volume 27, Issue 5, pp. 979-993., 2011
- [14] Madanmohan T. R., Kumar U., Kumar V.: *Import-led technological capability: a comparative analysis of Indian and Indonesian manufacturing firms*; Technovation; Volume 23, Issue 12, pp. 979-993., 2004
- [15] Mell P., Grance T.: *The NIST Definition of Cloud Computing, Recommendations of the National Institute of Standards and Technology – Special Publication 800-145*, NIST, 2011
- [16] QI X., Lan B., Guo Z.: *Conceptual Model of IT infrastructure Capability and Its Empirical Justification*, Tsinghua Science and Technology, Vol. 13, No. 3, pp. 390-394, 2008.
- [17] Peppard J., Ward J.: *Beyond strategic information systems: towards an IS capability*, Journal of Strategic Information System, Vol. 13, pp. 167-194, 2004.
- [18] Ross J. W., Beath C. M., Goodhue D L.: *Develop long-term competitiveness through IT assets*: Sloan Management Review, Vol. 38., No. 1, pp. 31-42, 1996.
- [19] Sambamurthy V., Bharadwai A., Grover V.: *Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms*, MIS Quarterly, Vol. 27: Iss. 2, pp. 237-263, 2003.
- [20] Stoel M. D., Muhanna W. A.: *IT capabilities and firm performance: A contingency analysis of the role of industry and IT capability type*, Information & Management, Vol. 46., pp. 181-189, 2009.
- [21] Webster J.; Watson R. T.: *Analyzing the past to prepare for the future: Writing a literature review*, MIS Quarterly; Vol 26., No. 2, pp. xiii-xxii, 2003
- [22] Willcocks L., Feeny D., Olson N.: *Implementing Core IS Capabilities: Feeny-Willcocks IT Governance and Management Framework Revisited*, European Management Journal Vol. 24, No. 1, pp. 28-37, 2006.
- [23] Willcocks L., Feeny D.: *IT Outsourcing and core IS Capabilities: Challenges and Lessons At Dupont*; Information System Management, Vol. 23, Issue. 1, pp. 49-56, 2006.
- [24] Yongmei L., Hongijan L., Junhua H.: *IT Capability as Moderator Between IT Investment and Firm Performance*; Tsinghua Science and Technology, Volume 13, No. 13, pp. 329-336, 2008.