PYRAMID MODEL – CONCEPTUALIZING AN ORGANIZATIONAL CAPABILITY TO DESIGN IT INVESTMENTS

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ABSTRACT
In this paper, a configurational framework to conceptualize an organizational capability, to design IT investments, is presented. IT is seen as a main driver of productivity and an enabler of digital innovations. At the same time, companies are struggling how to design IT investments. Based on Resource Based View of the firm and Dynamic Capabilities Framework, an organizational capability is considered as a basic unit, and a building block, of a competitive advantage. By building on those theories and systems thinking, Leavitt’s ‘Diamond model’, and Parsons’ model of an organization with ‘three levels of responsibility’, a ‘Pyramid model’ to conceptualize an organizational capability is developed. Suggested framework provides a foundation for business need-driven IT investment design at any level of an organization. In the ‘Pyramid model’ the recent understanding how IT can generate business value, is brought together and further developed. The model is expected to be highly valuable in practice helping to design and justify investments to drive productivity and e.g., to scale digital innovations.

KEYWORDS
IT Investment, Complementary Investments, Organizational Capability, IT Business Value (ITBV), Configurational Model

1. INTRODUCTION
Information technology (IT) has been a key driver of productivity during the last decades. In the near future, most of the productivity potential is expected to come from digital opportunities (Remes et al. 2018). The ‘modern productivity paradox’ (Brynjolfsson et al. 2017), and reported challenges in scaling of innovations (McKinsey 2019) anyhow indicate, that organizations are experiencing serious challenges with IT investments.

In IT business value (ITBV) research, where ITBV is defined as IT’s impact on firm performance (see e.g., Gandelman et al. 2019), there is an understanding that value is gained when IT is aligned with, or complementary to, other organizational variables (Kohli and Grover 2008). The prevailing approach has been IT-driven and reductionistic/pairwise (Fink 2011) where the impact of IT has been examined with complementary investments to one or a few organizational variables. The result is a field of scattered research with very limited support to practice, whereas for practical purposes, the holistic and business need-driven approaches have been recognized essential (Kohli and Grover 2008). To serve practice several configurational multivariate organizational models have been developed, but the challenge is in identification of the relevant organizational variables (Gandelman et al. 2019) and understanding of their interdependencies (Cao 2010). Typically, the models conceptualize operational level of an organization by ignoring organization’s hierarchical aspect, when management and adaptation to the changing environment has got very little attention.

The purpose of this research is to develop a configurational framework to conceptualize a systemic and evolving organizational capability which can be used as a basis to design IT investments including complementary investment to organizational variables (‘IT investments’ from now on). An organizational capability is defined as the firm’s ability to achieve desired goals by routinely deploying available resources (Amit and Schoemaker 1993). It is the basic unit, and a building block, of a competitive advantage, and therefore appropriate unit of analysis in this research. ‘Systemic’ refers to the organizational capability as a system consisting of interconnected and interdependent system elements operating in its task environment, and ‘evolving’ to its dynamic nature. Developed ‘Pyramid model’ is a foundation to design an IT investments to achieve targeted organizational capability.
2. BACKGROUND

2.1 IT Business Value Research (ITBV)

‘Invisible business value of IT’ with lacking, or in many cases at least delayed bottom-line impact, led to the extensive ‘productivity paradox’ discussion in 80’s and 90’s (Brynjolfsson 1993; Solow 1987). Although there is today a strong evidence that IT adds value (Kohli and Grover 2008) together with organizational variables, the same productivity discussion has popped up once in a while - most recently, at the eve of digitalization as a ‘modern productivity paradox’ (Brynjolfsson et al. 2017).

ITBV has been recognized to manifest through conversion processes (see e.g., Gandelmann et al. 2019) where commodity-like IT resource is converted to a synergistically operating and value enhancing asset embedded (Kohli and Grover 2008) to the organization and individual organizational capabilities within their context (see e.g., Schryen 2013) where alignment (Miller 1996) is pursued with coordinated complementary investments to adjust organizational variables (see review by Cao 2010). Regardless of an extensive and continuously sharpening body of research (see review e.g., by Schryen 2013) and development of several configurational multivariate organizational models (see Cao 2010), the challenge, and a research gap, is in identification of relevant organizational variables (Gandelman et al. 2019), understanding of their interdependencies (Cao 2010), and estimation of the performance impact of different configurations (Nevo and Wade 2010). Additionally, feasibility of the prevailing reductionistic/pairwise approach, especially in empirical investigations, has been questioned and the need for more holistic approach (Fink 2011), where ITBV is the behavior of the system (Ackoff 1999; Churchman 1971), has been emphasized.

2.2 Background Theories and Systemic Capabilities

The Resource-Based View (RBV) of the firm (Wernerfett 1984), where the firm is seen as a bundle of resources and capabilities (Amit and Schoemaker 1993), and Dynamic Capabilities Framework (DCF)(Teece et al. 1997), have provided valuable theoretical base to investigate how IT might help to create heterogeneity and strategic value (Cao et al. 2016). Capabilities can be divided to the potential i.e., what could be done, and realized i.e., what is actually done (cf. Penrose 1959; Zahra and George 2002). Ordinary capabilities have been categorized to operational capabilities executing day-to-day activities (Winter 2003) and managerial capabilities to “…run the organization and make and implement strategic and operational decisions…” (Hugill and Helfat 2016). Dynamic capabilities refer to the firm’s abilities to sense and seize new opportunities to develop existing capabilities, to reconfigure resources and capabilities, and/or to shape the task environment (Teece 2000; Teece et al. 1997). Dynamic managerial capabilities refer to the role and capacity of managers to orchestrate these changes (Adner and Helfat 2003; Harris and Helfat 2018). It has been also suggested, that companies possess non-routinized and less structured improvisational / ad hoc capabilities (Pavlou and El Sawy 2010; Winter 2003). Here an organizational capability is defined to consist of operational, dynamic, and managerial capabilities with varying degrees of routine.

Systems theory (ST) has been suggested as a complementary theoretical lens to the RBV and DCF to study ITBV (Cao et al. 2016; Nevo and Wade 2010). In ST, an organization is seen as a system consisting of system elements, composed of interrelated subsystems, where the value is the behavior of the whole system with synergies and emergent properties rather than separated parts (Ackoff 1999; Churchman 1971). To maintain equilibrium, a change in any of the system elements, would most probably result compensatory changes in others (1965). The compatibility and interaction, of the system elements define the performance of the system (Ackoff 1999; Galbraith and Kazanjian 1986). In this research, capabilities are considered as systemic.

2.3 Leavitt’s Diamond Model

In Leavitt’s (1965) ‘Diamond model’ an organization is seen as a multivariate system consisting of four organizational variables. Task refers to an organization’s raison d’être i.e., desired outcomes. Structures are formal allocations of work roles and administrative mechanisms to organize, coordinate, and control work activities, including those that cross formal organizational boundaries. They are created by management (Penrose 1959), and consist of systems of communication, systems of authority (roles, responsibilities and
power), and systems of workflow. With technology Leavitt referred to the problem-solving inventions - mainly technical tools. Actors refer mainly, but not always, to the people. The variables are interdependent and consistently striving towards equilibrium. The model has been criticized of ignoring certain variables and therefore extensions has been suggested (see e.g., Davis and Olson 1985; Nograve 2011; Scott Morton 1995). In this research, a few extensions and several specifications to the original models are done.

2.4 Parsons ‘Three Levels of Responsibility and Control’

Parsons (1960) broke down the hierarchical aspect of an organization and identified three levels of responsibility and control (‘level’ from now on) responsible of solving different classes of problems (see also Thompson 1967a). Operational level is responsible of conducting operational tasks i.e., the actual ‘process’ where physical production of goods and/or services occurs. Managerial level is focused on effective performance of the operational level by organizing, coordinating, controlling and ‘servicing’ it (Thompson 1967a). This task can be divided to ‘external relations’ i.e., mediation between the organization and the task environment, and ‘internal relations’ i.e., administration of the organization’s internal affairs. From external relations point of view, the managerial system services the operational sub-organization by procuring the resources (‘resource-acquistion problem’ Thompson 1967b) necessary for carrying out the operational tasks, and by mediating between the operational sub-organization and those who use its products i.e., disposal of products (Parsons 1960; ‘output-disposal problem’ Thompson 1967b). From internal relations point of view management system determine topics in the operational level like scale of operations, allocation of resources, integration, coordination, as well as administration and control of the operations (Thompson 1967b). On institutional level an organization needs to articulate with ‘organized superior’ agency. The organization is part of a wider social system which is the source of the ‘meaning’, legitimation, and the higher-level support controlling the organization (Thompson 1967a). Qualitative breaks exist between levels at the point where the levels connect. The levels have two-way interaction and interchange of essential inputs and outputs including information (Thompson 1967).

3. THE ‘PYRAMID MODEL’

3.1 Adjusted Capability Levels

An organizational capability consists of three interdependent and partially overlapping levels - each with its own types of responsibilities. The operational level is the raison d’être of an organizational capability responsible of conducting the day-to-day value adding activities i.e., physical production of goods and/or services. This is consistent with Parsons’ definition.

The dynamic level is responsible of maintaining equilibrium of an organizational capability. It is partially overlapping with managerial and operational levels. Parsons recognized the dependency from environment and related uncertainty but did not explicitly include this ‘system of change’ as an own level to his model. In ‘Pyramid model’ the dynamic level is considered as an own level with two sub-levels: Dynamic operational level’ is responsible of adjusting and developing existing capabilities and ‘Dynamic managerial level’ responsible of reconfiguration of resource position and capabilities, and shaping the task environment.
The managerial level is responsible of effective performance of operational and dynamic levels, and the tasks of original institutional level. ‘Servicing’ responsibility is divided here to the ‘managerial services’ (operational managerial task) and ‘entrepreneurial services’ (dynamic managerial task) accordingly (Penrose 1959). They both include the responsibility of ‘leadership’ (see figure 1).

3.2 Capability Variables

A capability is defined to consists of four interdependent capability variables. Unlike Leavitt, an open system logic is assumed. To represent selected background theories (RBV and DCF), the variables are adjusted and further specified (see figure 2). Compatibility and interaction of capability variables, and task environment, define the performance of a capability.

Coherent ‘Tasks, Abilities & Qualities’ are the starting point for defining the targeted capability, derived from the business needs. By complementing Leavitt’s original model, tasks define the expected actual outcomes and purpose i.e., the realized capability (or activity). Abilities are potential evolution paths (Teece et al. 1997) what could be done either immediately (potential capability), or readiness to develop the capability to a certain direction (i.e., paths available to it). Qualities are non-functional requirements (NFR).

‘Technologies’ consist of product technology, value configuration technology (VCT) with frequency, and information systems (IS) technology (Porter 1985). The product technology defines the technical details of the outcome. VCT (see e.g., Fjeldstad and Snow 2018; Thompson 1967a) defines how resources are utilized, and inputs combined/integrated to produce the throughput. Frequency defines how many times it is exercised in a certain time frame. The IS technology defines how data and information is gathered, processed, stored, delivered/accessed, and utilized. Leavitt defined ‘technologies’ only as “problem solving inventions - mainly technical tools”, which are considered here as ‘resources.’

‘Resources & Sub-capabilities’ cover all available resources and sub-capabilities forming a resource position. A capability is highly dependent of available resources, and their mutual compatibility and interaction i.e., potential co-specialization and fit. To align with basic postulates of RBV and DCF, routine is considered as a resource, defined as a patterned and repeated way to conduct one or many interconnected task(s) by an actor (individual routine) or by multiple actors (organizational routine). Routine evolves in a continuum from weak/non-existing (i.e., improvisational/ad hoc capabilities) to strong/perfectly routinized.
‘Structure & Culture’ is the ‘administrative framework’ (Penrose 1959) i.e., a formal allocation of resources and administrative mechanisms to organize, coordinate, control capabilities - including the ones that cross formal functional and organizational boundaries. To Leavitt’s original definition I’m including incentive system, and culture (organizational and/or micro) referring to the values and beliefs mediating the behavior of individuals (i.e., a steering mechanism) by giving values and social order (Schein 2010).

In his original model, Leavitt assumed a closed system logic. Here, to better represent DCF, organizational rationality, and Parsons’ model, an open system logic is assumed. Accordingly, capability is dependent of, and controlled by, its task environment (see Pfeffer and Salancik 1978) which as a wider social system gives e.g., the meaning, legitimation, and the higher-level support to the capability.

3.3 Synthesis: Organizational Capability Consists of Three Types of Capabilities

The above presented adjusted capability levels and capability variables are synthetized to ‘Pyramid model’ (see figure 3). Accordingly, an organizational capability consists of three interdependent and overlapping levels i.e., types of capabilities (operational, dynamic, and managerial), each consisting of four interconnected and interdependent capability variables (‘Tasks, Abilities & Qualities’, ‘Technologies’, ‘Resources & Sub-capabilities’, and ‘Structure & Culture’).

**Operational capability.** The task of an operational capability is to deliver the outcome(s) expected from the organizational capability. Abilities are potential evolution paths for the future (potential capability or readiness). ‘Qualities’ define the non-functional criteria for the operational capability (e.g., ecology, profitability, etc.). ‘Technologies’ define the technical details of an outcome (product technology). VCT and frequency define how resources are used and outcomes combined, and how many times it needs to be repeated in a certain time frame. How received and generated data and information is gathered, processed, stored, delivered/accessed, and utilized is defined by IS technology. ‘Resources & Sub-capabilities’ consist of all available internal and external resources, (outcomes of) sub-capabilities, and routines to combine those. ‘Structure & Culture’ define how an organizational capability is organized, coordinated, and controlled; and what are the common values and beliefs impacting to the behavior.

**Dynamic capability.** The task of a dynamic level is to keep an organizational capability vital and to ensure its evolutionary fitness by maintaining internal and external equilibrium. Task is divided to dynamic operative task i.e., development and adjustment of the existing elements and their interaction of an organizational capability, and dynamic managerial task i.e., maintenance of an optimal resource position, capability configuration, and fit with task environment. Abilities are potential dynamic capabilities what could be utilized immediately and/or readiness to develop those to a certain direction. Qualities define the non-functional criteria. ‘Technologies’ define the technical details of outcomes (product technology), how an equilibrium is maintained (VCT) and frequency. IS technology defines how data/information is gathered, processed, stored, delivered/accessed, and utilized to conduct the tasks. ‘Resources & Sub-capabilities’ consist of all available
resources, (outcomes of) dynamic sub-capabilities, and routines to conduct the tasks. Of these, the *dynamic operative capability* is responsible of *dynamic operative tasks* (defined above). Dynamic managerial capability is responsible of *capability reconfiguration* (internal domain) and *shaping of the task environment* (external domain). Dynamic capabilities include *improvisational capabilities* to handle unfamiliar ad hoc problems. ‘Structure & Culture’ forms an administrative mechanism including common values and beliefs guiding development and adjustment of an organizational capability.

Figure 3. The ‘Pyramid model’, types of capabilities, and main tasks in internal and external domains

The task of managerial level is to ensure achievement of targeted performance (*operative managerial tasks*) and maintenance of evolutionary fitness (*dynamic managerial tasks*) of the operational capability. The first one is divided to capability execution and maintain external relations -tasks. The dynamic managerial task is overlapping part with dynamic level covered above. Abilities are either potential managerial capabilities what could be utilized, and/or readiness to develop those to a certain direction. Technologies define the technical details of managerial outcomes (*product technology*), management methods and frequency how managerial tasks are conducted (*VCT*), and how information and insights are utilized (*IS technology*). ‘Resources and Sub-capabilities’ consist of all resources, outcomes of sub-capabilities and routines to conduct the managerial tasks. Managerial level is organized, coordinated, and controlled by higher level social system (their managers, business owners, and institutional structures and agencies) which together determine the ‘Structure & Culture’.

3.4 Degree of Equilibrium

An organizational capability as a system of interdependency strives towards equilibrium in internal and external domains. The *degree of equilibrium* tells how well it has been achieved. An *external equilibrium* is defined as a compatibility and interaction with external environment i.e., how effectively the organizational capability interacts and is coherent with it. The higher the degree of external equilibrium, the more effective the organizational capability is. An *internal equilibrium* is defined as the compatibility and interaction of the levels (i.e., types of capabilities), capability variables, and elements inside the capability variables. The higher the degree of internal equilibrium, the more efficient the capability is.
4. CONCLUSIONS

The developed ‘Pyramid model’ is a multivariate model to conceptualize an organizational capability - the building block of a competitive advantage. Based on two well accepted, but modified and combined organizational models, it represents selected underpinning theories of RBV, DCV, and ST. An organizational capability is defined as consists of three levels i.e., types of capabilities – each with own types of responsibilities. The levels consist of four interdependent capability variables. The tasks of each level are based on business needs and might pertain expected outcomes (tasks), abilities to do something (i.e., evolution paths), or qualities (how things are done). The model also recognizes hierarchical structure of capabilities. It advances the holistic view and business need-driven approach in ITBV. It is based on the concepts of embeddedness, equilibrium, and dynamism as key attributes of an organizational capability. To the best of author knowledge, the ‘Pyramid model’ is in many ways unique and more advanced than e.g., prior organizational models.

The ‘Pyramid model’ with holistic approach to conceptualize a business need-driven organizational capability to design an IT-investment is expected to be highly valuable in practice. It can be applied throughout the IT investment life cycle in investment design, justification, during the transformation, and ex post assessments. It is expected to help to improve quality of investment initiatives, potentially leading to higher success rate and shorter periods of ‘temporary productivity loss’ (Brynjolfsson 1993).

The ‘Pyramid model’ necessitates good understanding of the applied concepts. This is anyway a deliberate choice to get closer to the organizational rationality and complex phenomenon of IT investment with targeted ITBV. Although it provides a basis for structured way to identify required complementary investments, its application still necessitates a procedure with supporting tools, and a good understanding of the capability with constituting elements, their interaction, and the context. The model does not tell anything about the means to conduct the required adjustments nor organization’s absorptive capacity (Zahra and George 2002).

The ‘Pyramid model’ opens a way for testing of holistic IT investment configurations. It should be also applied with different organizational capabilities, with linked capabilities (e.g., when ITBV could be realized only through linked capabilities known as 'locus of value' Kauffman and Weill 1989), and in capabilities of different level in an organization (e.g., on business model level) or even in wider entities (e.g., ecosystems).

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