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Analyzing Organizational Capabilities as Systems: A Conceptual Framework

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Abstract: Operational capabilities are used in resource based view in strategic management literature to explain how the difference in performing similar activities results in heterogeneity between firms. In order to advance our understanding of this concept, using a system metaphor, we try to shape a framework for micro-level analysis of operational capabilities. Following two stages of holism and focus for identifying system boundaries through looking related literatures, we propose knowledge, skills and tools as general micro elements of operational capabilities in form domain. Using Dependency Structure Matrix (DSM), we finally synthesize our conceptual framework to capture interactions of aforementioned micro elements and to show how this system works toward sub activities in function domain which their integration to a whole provides the firm with an operational capability. This paper is the first step in using a system metaphor to investigate organizational capabilities and paves the way for future researches of its kind.

Keywords: Organizational capabilities, Operational capabilities, Micro-level analysis, system metaphor, system analysis, form domain, function domain, interactions, Dependency Structure Matrix (DSM), literature review

1 Introduction

A firm's success depends on the congruence between its portfolio of activities and its external opportunities as well as the quality of performing such set of activities (Saloner et al., 2001). Resource based view (RBV) in strategic management literature has acknowledged the important role of organizational capabilities in explaining how good firms can perform their activities (Grant, 1991; Amit and Schoemaker, 1993). A distinction is generally made between operational capabilities (OCs) and dynamic capabilities, so that the former enables firms to perform their ongoing tasks of making a living (Helfat, Finkelstein et al., 2007), while the latter concerns building, integrating or reconfiguring operational capabilities (Kiamehr, 2012). This paper only deals with OCs. In recent decades, a large body of literature (for example: Penrose, 1959; Rumelt, 1984; Wernerfelt, 1989 and Barney, 1991) has been produced on the nature and importance of firms' capabilities within RBV strand (Kiamehr, 2012). Despite years of development and many theoretical contributions, the conceptualization, operationalization, and application of RBV has remained problematic (Noori et al., 2012). One aspect of the literature that still seems to be unsettled is the confusion over the definition of this concept (Kiamehr, 2012). Capabilities refer to the organization's potential for carrying out a specific activity or set of activities (Grant, 1991; Amit and Schoemaker, 1993; Teece and Pisano, 1994; Fernandez et al., 2000; Helfat and Peteraf, 2003; Galbreath, 2005) but there is no consensus on OCs definition in the literature (Kiamehr, 2016). For the purpose of this paper, we define an organizational capability (OC) as an actual synthesis of organizational assets which allows for performing some specific activities.

Most sciences or subfields, in their early stages of development, begin at some aggregate level of analysis and thus implicitly assume that micro-level phenomena has relatively uniform effects on aggregate level phenomena, and/or that variation at the micro-level does not inform variation of aggregate level phenomena (Felin et al., 2012). As fields progress, evidence suggests that assumptions about micro-level uniformity prove unsustainable and inaccurate (id.). Indeed, micro-level phenomena are often more idiosyncratic in nature than not (McKelvey, 1998). Advancing the understanding of particular phenomena and, in turn, a field, thus may require expanding theoretical and empirical work to encompass multi-level effects, including micro-level effects (e.g. Hitt et al., 2007). Elster (1989, p. 74) indeed argues that 'reduction is at the heart of progress in science'. Scientific reduction is a call for explaining collective phenomena and structures in terms of what are seen as more fundamental, nested components (Kincaid, 1997) and the search for, and explication of, the constituent components that underlie aggregate and collective phenomena (Felin et al., 2012).

To shape a micro level understanding of organizational capabilities, it seems fruitful to use a system metaphor. This idea rose from the similarity between definitions of organizational capabilities and systems. Systems are defined as a set of entities and their relationships, whose functionality is greater than the sum of the individual entities (Crawley et al., 2015). In our aforementioned definition of OCs, a synthesis of organizational assets is a set of entities which their relationships makes performing some activities possible for the firm which are not possible in such a way otherwise. So, it seems that considering organizational capabilities as systems and doing system analysis at micro level bears fruit.

This paper aims to present a conceptual framework as a basis for analyzing OCs as systems. The above discussion shows that such framework may help to have a better understanding of OCs and to decrease current conceptual ambiguities in related literatures.

The next section of this paper analyzes OCs using system science literature. The third section, synthesizes our conceptual framework. The final section presents some limitations of this work and also spreads an agenda for future researches.

2 Organizational capabilities as systems

Systems simultaneously have the characteristics of form and function (Crawley et al., 2015). Form is what the system is and function is what the system does (id.). System science considers both domains for system analysis. Discrete parts of related literatures have also analyzed OCs in both form and function domains. In this section, we first try to identify micro elements of OCs in the function domain as well as their interactions. Thereafter in the second subsection, OCs are decomposed in the form domain while their interactions are also considered. Finally we will link those two domains to show how the system integrates to a whole which enables the firm for doing specific activities.

2.1 Analysis in function domain

Function domain deals with what a capability can perform, i.e. activities. For analyzing an OC in the functional domain, it should get decomposed into its underlying sub activities first. Each sub activity may again be decomposed to its lower layer sub activities. This decomposition process could be continued until we reach to simplest tasks in the lowest layer. Some of related literatures has analyzed OCs in the function domain. For example, when CoPS (Complex Product Systems) literature breaks systems integration mega capability into functional, project and strategic management sub capabilities (Davies and Hobday, 2005), analysis has been done in function domain. Again, when innovation studies consider idea generation, design and development, implementation and commercialization as major sub capabilities of innovation capability (Tidd et al., 2005, Cagliano et al, 2000), they are speaking in function domain. For many of today's products with a systemic nature, the design and development sub activity itself, could be braked into system level and component level design sub activities (Crawley et al., 2015). Figure one proposes such decomposition for innovation capability and also for its design & development sub activity into its second layer.

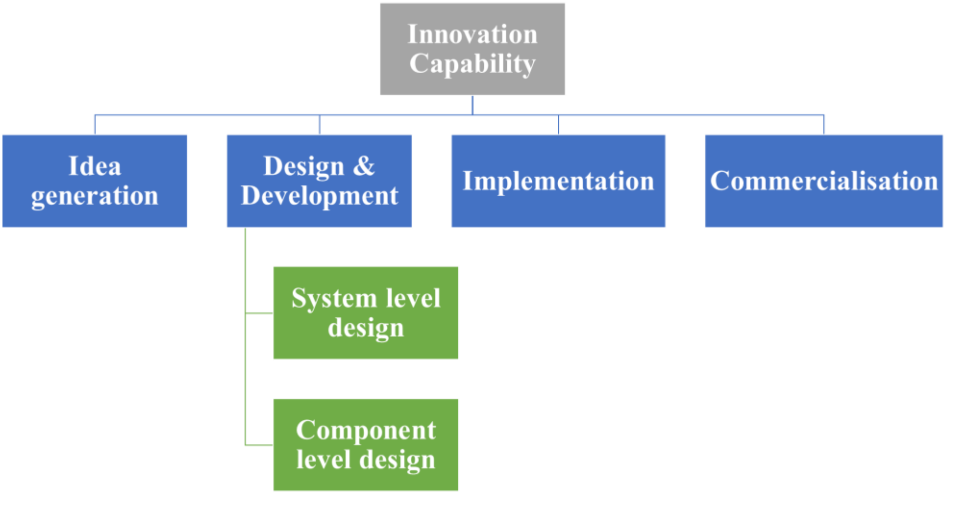

Figure 1. Analysis of innovation capability in function domain

Afterward, the interactions of micro level sub activities could be considered. These interactions which occur through a process or routine, then integrate into a whole capability which allows the firm for doing a specific set of activities. Table one illustrates those interactions for a typical OC at its first level of decomposition in function domain using Design Structure Matrix (DSM) which is widely accepted in system science for presenting interactions in a system. The red (Bold) lines in this figure, show the system (OC) boundary. The system receives inputs from its environment and acts upon the operand to change the operand while there would be some other outputs (byproduct) too.

Table 1. First level interactions of a typical OC in function domain

OC	Inputs	Operand	A1	A2	…	An	Changed operand	Other Outputs
Inputs			•					
Operand			•					
A1				•	•			
A2					•			
…						•		
An							•	•
Changed operand								
Other outputs								

To provide an example, table two decomposes innovation capability in the function domain to its first level sub activities.

Table 2. Analyzing innovation capability in function domain at the first level of decomposition

Innovation capability	1	2	3	4	5	6	7	8
1: Budget, …			•	•	•	•		
2: Previous product			•	•	•	•		
3: Idea generation				•				•
4: Design & Development					•			•
5: Implementation						•		•
6: Commercialization							•	•
7: Innovated product								
8: Job satisfaction								

2.2 Analysis in form domain

The form domain deals with what the system is. In regard of micro elements of OCs in the form domain, related literature has provided a wide list. Leonard-Barton (1992) suggests that skills and knowledge bases (embodied in people or disembodied in the form of technical systems) are at the core of capabilities, but certain organizational dimensions affect this core. These dimensions include managerial systems (such as formal and informal ways of creating knowledge), organizational norms and values assigned to various types of knowledge (such as engineering versus marketing expertise) and processes of knowledge creation and control (such as formal degrees versus experience) (Kiamehr, 2012). Prahalad and Hamel (1990) as well as Lall (1992) specify capabilities as mere skills or knowledge sets. The range of micro elements in the literature is in fact broader than merely organizational and technical elements (Henderson and Cockburn 1994; Levinthal and Myatt 1994; Bell and Pavitt 1995), and for example includes important personal characteristics of individuals, especially managers (Augier and Teece, 2006; Teece 2007). Christensen and Caufman (2006) have emphasized on resources, processes and priorities in this regard. Felin et al. (2012) has pointed to individuals, processes and structures as three main categories of micro elements. Porter (1995) and Drejer (1996) imply to knowledge, hardware and skills while talking about technological capabilities. Such a long list may be beneficial as all elements that might be important to the system should be initially identified through a holistic thinking (Crawley et al., 2015). The next issue that the system thinker faces is focus—that is, to identify what is important to the question at hand (id.). Expanding outward from the system, the first level of context we encounter includes the other objects that are not part of the system but are essential for the system to deliver its functionality (id.). These are called the accompanying systems (id.). The sum of the system and the accompanying systems is called the whole system (id.). The system is separated from the accompanying systems by the system boundary (id.). Expanding one more step outward, we find the next level of context, the use context (id.). The whole system fits within this use context, which includes the other objects that are normally present when the whole system operates but are not necessary for it to deliver its function (id.). The use context is important because it informs the function of the system (id.). It gives place to the whole system, and it gives us information on the environment in which the system operates and informs system design.

The aforementioned discussion clears that from the wide list of micro elements from the literature, some should be considered inside the systems boundary as the main micro elements of OCs while some others should be considered as accompanying systems and some others would be better to place in use context. This classification depends on the question at hand but some general guidelines seem recommendable.

This paper limits itself with managerial implications and tries to provide a better understanding of OCs as a basis for their improvement plans. So it may be a good idea to separate those elements under managerial control within the firm from those which are placed in external environment such as national infrastructures. Those external elements could be dealt with as external opportunities in use context. Although some other elements such as organizational culture are internal to the firm, they are very hard to control at least in short term and they also are not attributable to any specific capability. So, they could be considered as accompanying systems in the whole system. Strategy literature has also acknowledged that OCs perform within an organizational context (Leonard-Barton, 1992; Porter, 1985 and Drejer, 1999). So, we adopt knowledge, skills and tools from strategy literature (Leonard-Barton, 1992; Porter, 1995 and Drejer, 1996) as general micro elements of capabilities in form domain. Fig. two shows OCs' boundary within organizational boundary, accompanying systems and the use context in the form domain.

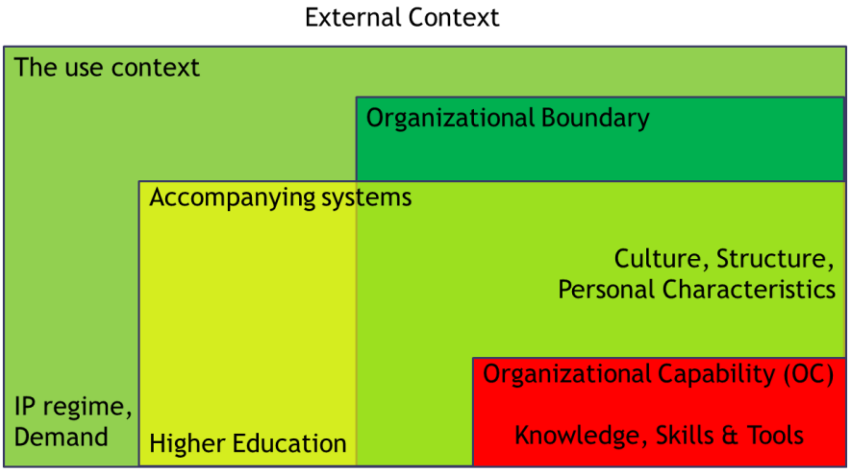

Fig 2. Operational Capabilities boundary within its environment in the form domain

These micro elements interact to perform an activity, sub activity or just a simple task. Using DSM, table three illustrates those interactions for a simple task (Ti) at the lowest level of decomposition. As the figure shows, skills are the main synthesizing mechanism of OCs which utilize other organizational assets (Knowledge and tools) to perform a task. It worth to note that tools have embodied some sorts of knowledge and skills themselves which are not completely captured in this figure.

Table 3. Interactions of microelements of operational capabilities in the form domain

Ti	Inputs	Operand	Know-How	Tools	Skills	Changed operand	Other outputs
Inputs				•	•		
Operand				•	•		
Know-How				•	•		
Tools					•		
Skills						•	•
Changed operand							
Other outputs							

In order to provide an example, table four represents the analysis of component level design sub activity (which we had mentioned in the previous sub section) in the from domain. In this table, budget is one of the system inputs which is necessary for the system to operate. Designers with optimization skills deploy their component knowledge and also design softwares to change the component specifications which are delivered from the system level design sub activity of the figure one (System’s operand) into component design documents. Verification documents may be considered as other outputs of this sub activity.

Table 4. Analysis of component level design sub activity in the form domain

Component level design	1	2	3	4	5	6	7
1: Budget,…				•	•		
2: Component specifications				•	•		
3: Component knowledge				•	•		
4: Design software					•		
5: Optimization skills						•	•
6: Component design docs							
7: Verification docs							

3 Conceptual framework

To synthesize our conceptual framework, we need to link the two aforementioned domains to show how OCs perform their function as a whole system. For this purpose, we adopt IDEF0 (a widely accepted modeling standard in system science) as the basis for our conceptual framework. Figure three represents our conceptual framework which links OC's micro elements in both form and function domains as well as their interactions.

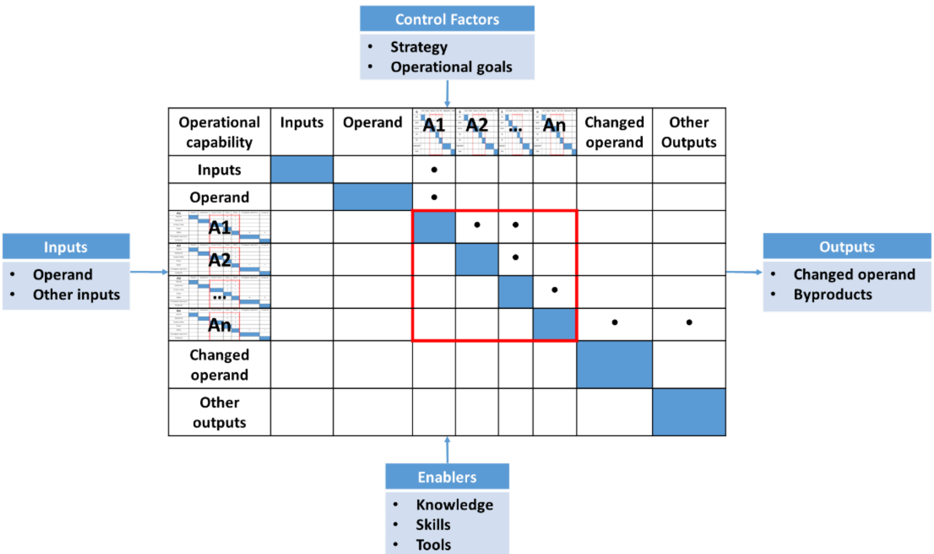

Fig 3. Conceptual framework for analyzing operational capabilities as systems

As this figure shows, operand and other inputs enter the OC from the external environment. Knowledge, skills and tools as general micro elements of OCs are enablers of OC which interact to perform each of sub activities A1, A2…An. Their interactions (which has been presented in table three has been zoomed out and captured into cells labeled A1, A2…An. Interactions in function domain (between sub activities) has been reflected in the bigger table and results in changed operand and probably other byproduct. This transformation are controlled and constrained with strategic and operational goals of the firm which reflect all affecting factors in the OCs context.

4 Closing remarks

This paper tried to contribute to strategy literature through providing a better understanding of the operational capabilities. For this purpose, we proposed a new lens to look to OCs as systems. Using system science concepts and tools, we decomposed OCs to their micro elements in both form and function domains and captured their interactions as well. Our final conceptual framework linked the two domains to show how the interaction in two domains integrates to perform specific activities as a whole system. Such an approach to organizational capabilities is new. Although a few of researches has implicitly (Morgan, 2005) or explicitly (O'Connor, 2008) mentioned OCs as systems, there are no try to operationalize such a metaphor. Thus, this work has set the agenda for a new strain which understands OCs and probably dynamic capabilities as systems.

Our conceptual framework may have considerable managerial implications. It can be used as a framework for gap analysis in OCs and as a basis for improvement plans. With considering other micro elements, it can be used as a guide for policy making as well.

Systems lifecycle includes different stages. In the highest level, a firm is able to conceive, design, implement, operationalize and dispose an OC. This paper have focused on operationalization phase only. Future work may investigate other micro elements of OCs and their interactions during other phases of lifecycle. For example, know-why is mostly utilized to inform process design knowledge in design phase. It is also worth to note that process design knowledge is different from utilization know-how which reflects a kind of user's manual. Using this framework in empirical settings seems also fruitful in the future works.

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