A synthesis of diverse organizational capability typologies and classifications

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Abstract

The concept of capability, despite the fact of having gradually been established as a valuable construct for business analysis and design, remains vaguely defined and classified. A wide spectrum of diverse definitions and perspectives exists in the literature, and this has led to an equally wide and diverse spectrum of typologies based on different aspects and focal points. Synthesizing a variety of such perspectives, which is the aim of this paper, has the potential to improve the understanding around the concept of capability and enhance the means to communicate its value. A literature review has been performed in order to identify a set of existing capability typologies and classifications, and the elicited set has been synthesized and visualized in order to provide a basis for a capability ontology, derived from the existing perspectives in the literature.

Keywords

Capability, Typology, Classification, Synthesis, Dynamic capabilities, Hierarchy, Domain-specificity

1. Introduction

Capability, as a conceptual construct, and capability thinking, as a practice, are gradually gaining ground as enablers and facilitators for the documentation, planning, design, and analysis of businesses [1].

A noteworthy fact about business capabilities is the lack of a consistent and unanimous definition in the literature [2]. This situation is further amplified by the fact that the theory of dynamic capabilities [3] provides a wider spectrum, of definitions that raise significantly the degree of ambiguity regarding the definition of capability.

This situation has also led to a wide spectrum of typologies and classifications about capabilities, derived both from academia and the industry. There are both generic and domain-specific typologies, often focusing on hierarchical aspects that also include dynamic capabilities. While the absence of an unanimously accepted definition can be recognized as a problem, in this paper, it is treated as an opportunity to improve the comprehensibility of the concept of capability by synthesizing diverse perspectives about it.

The existing classifications and typologies are derived from theoretical definitions following a top-down approach. With this study, an initial attempt to redefine capabilities using a bottom-up approach is performed. The types and categories are a result of applying theoretical frameworks

on practical situations, and in this way, these elicited categories can also be considered as instances of the category. Thus, identifying a variety of aspects which are relevant to the description of the concept of business capability can set the basis for an ontological analysis and description of business capabilities on all levels, from operational to strategic.

Therefore, the goal of this paper is *to provide an initial synthesis of capability perspectives, as identified via typologies identified in the literature.*

The rest of the paper is structured as follows. Section 2 provides a brief overview of the relevant background and Section 3 explains the methodological decisions that have impacted this study. Sections 4 and 5 describe an identified set of capability typologies in the literature and their synthesis in the form of a conceptual model respectively. Section 6 presents a brief discussion about the study and Section 7 provides concluding remarks.

2. Background

This section provides a brief overview of the main topics in capability research and practice.

Business capabilities are most often classified as operational or dynamic, with operational capabilities referring to an organization's potential to perform activities, on an ongoing basis using the same techniques on the same scale, as a means to support product or service delivery for the same customer population [4].

Capabilities have always been associated to dynamic business environments, and have been used as a means to analyze all the aspects of an organization that changes what it is capable of as a response to the environmental dynamism [5]. This fact led to the concept of dynamic capability [6, 7]. Despite its high popularity, the concept of dynamic capability remains a source of confusion, since it has been defined in so diverse ways that result in inconsistencies. For example, dynamic capability has been defined as ability, orientation, process, capacity, design, or mechanism [2]. The diversity in definitions is a probable effect of not only including the term "capability" which has diverse definitions, but also the term "dynamic" which has a double meaning, both as something that is "active or changing" and "something that causes change or growth in something else" [8]. This is a potential point of confusion between something that is being changed and something that is provoking change in something else. However, the popularity of the term has resulted in diverse typologies that refer to dynamic capabilities, so they cannot be ignored in a study such as the current one. As a means to avoid the potential confusion, this study considers dynamic capability as a specialization of strategic capability, meant to affect operational capabilities, which reflects on the majority of the relevant typologies.

There are various means to document, analyze, design and communicate the capabilities of an organization. Common approaches are capability mapping [9, 10], capability modeling, as a specialization of Conceptual and Enterprise Modeling with a focal point on capabilities [11, 12], and more traditional high-level business analysis techniques, like canvas-based approaches [13].

The concept of capability has been used and applied in a variety of domains, regardless of the practice, that is, capability mapping, modeling, or any other type of analysis.

A few examples of domains that have been combined with capability thinking are Enterprise Modeling [1, 14], Enterprise Architecture [15, 16, 17], Requirements Engineering [18], Risk Management [19], and Change management [20].

3. Methodology

The aim of this paper is to identify a variety of capability typologies and classifications that exist in the literature and attempt an initial synthesis, as a step towards a unified ontology that will facilitate an improved understanding of the concept of capability and its usage both in academic research and practical application in businesses.

Regarding the data collection, in order to elicit an initial set of capability typologies and classifications, a search has been performed on Google Scholar, using the keywords:

capability classification OR typolog* AND business OR organizational OR enterprise capabilit**

The initial findings have been combined with a snowballing technique to complement the initial collection. The combination of the two data collection techniques led to the identification of the capability typologies and comprise the literature review performed in this study. The identified typologies and classifications have been extracted and their types have been documented.

Regarding the synthesis, the overlapping and compatible aspects in the analyzed typologies have been identified, abstraction has been used wherever applicable and the results have been visualized as a conceptual model. The page limitations of this paper do not allow a detailed presentation of the semantic comparisons performed on the capability type and category concepts using in the performed synthesis.

4. Capability typologies in the literature

As mentioned earlier, the literature on business capabilities includes a wide and diverse spectrum of typologies and classifications. An equally diverse aspects have been employed as focal points for the classification of capabilities. The majority of the identified typologies include the hierarchy of capabilities as a classification aspect, and this is naturally involving the theoretical comparison between capabilities and dynamic capabilities. Another popular aspect is the domain-specificity [21] that determines domain-specific capability types.

4.1. Hierarchical typologies

Regarding the hierarchy of capabilities, the main idea behind it is that there are various different capability levels, a viewpoint which suggests that higher-level capabilities affect the lower-level capabilities. A few examples of hierarchical capability typologies follow:

- Collis [22]: The typology of Collis classifies business capabilities in five main types. Initially, Collis identifies the (i) first category, which refers to an organization's ability to perform basic business functions. The (ii) second category refers to capabilities that concern dynamic improvements on the organization's activities, and the (iii) third category, which is a lot alike the second, refers to capabilities that help recognize the intrinsic value of specific resources or develop innovative strategies ahead of competing organizations. Collis's fourth category, the (iv) meta-capabilities, which refers to the

capabilities to develop capabilities. However, this category leads to the conceptually problematic existence of capabilities to develop capabilities to develop capabilities, which also comprises the fifth category of Collis, the (v) ad infinitum capabilities [22].

- The typology suggested from Danneels [23] is another hierarchical typology that emphasizes at the operational level of the organization, naming this category (i) first-order capabilities, and the dynamic aspects of the strategic capabilities that lead to the category (ii) second-order capabilities. These two are the only categories that comprise this typology.

- The typology introduced by Winter [24] consists of three categories for classifying business capabilities. The focal point of the typology lies in dynamic capabilities, therefore, operational capabilities are considered the first category, the (i) zero-level or ordinary capabilities. The second category, (ii) first-order capabilities refer to the more traditional perspective of dynamic capabilities, which enable an organization to change its ordinary capabilities. Finally, (iii) higher-order capabilities, which is the third and last category of this hierarchical typology, concerns more advanced dynamic capabilities that enable strategic innovation that leads to competitive advantages to a higher degree that the one provided by first-order capabilities. A noteworthy fact here is that the term "first-order" has been used identically in the last two typologies, however, their semantics are referring to entirely different categories.

- The next typology, introduced by Zahra et al. [25], classifies capabilities in a similar way to the previous hierarchical typologies. Basically, the main classification aspect is between operational and strategic capabilities. The difference is in the selected terminology. The operational capabilities are named (i) substantive or ordinary capabilities, and the second category is named (ii) dynamic capabilities.

- The next hierarchical typology comes from Ambrosini et al. [26]. The first type of the typology (i) is called "Resource base" and refers to the operational, ordinary, zero-order or first-order capabilities that have also been part of the previous typologies. The second and third types in this typology are (ii) incremental and (iii) renewing capabilities, which affect the resource base. Finally, the fourth category is the (iv) regenerative type, which affects the previous two categories.

- One more hierarchical typology comes from [27]. The authors treat the operational or ordinary capabilities as their first category, namely (i) Classical capabilities, and distinguish between the levels of dynamic capabilities according to three aspects derived from how dynamic capabilities are managed. In practice, they distinguish among three categories of dynamic capabilities, which are, (ii) radical, (iii) integrated, and (iv) routinized.

4.2. Other typologies

A variety of domain-specific typologies exists in the literature and it bears significance to overall capability thinking. A few examples follow:
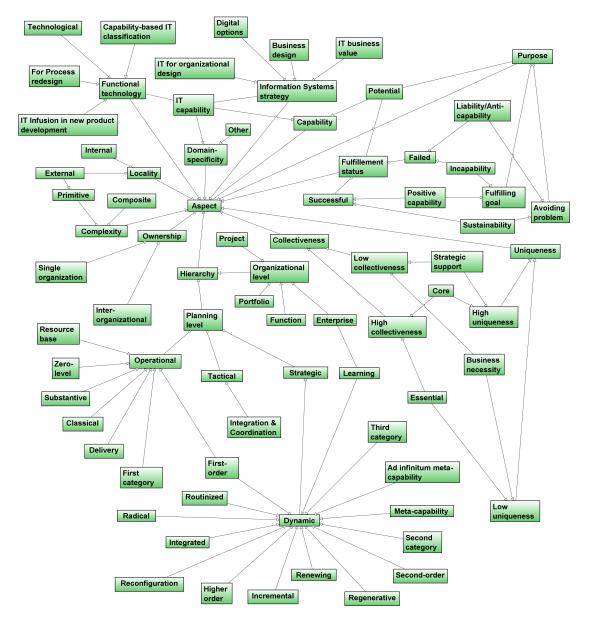
- When it comes to IT capabilities, a typology has been introduced by Lee et al. [28]. Two main aspects have been used for the classification of organizational capabilities. The first one is the Functional Technology level. According to this perspective, capabilities

can be classified as (i) IT capabilities for Process Redesign, (ii) Technological capabilities, (iii) IT Infusion in New Product Development, and (iv) Capability-based IT classification. The second applied perspective is the Information Systems Strategy level. Based on this aspect, organizational capabilities can be classified as (i) Business Design, (ii) IT Business Value, (iii) Digital options, and (iv) IT for Organizational Design.

- One domain-specific typology regarding multi-agent systems has been introduced and reported by White et al. [29]. The two classification aspects used in the study are Complexity and Locality. Applying the Complexity aspect results in two main capability types, (i) primitive, and (ii) composite. The locality aspect results in two other types, in particular, (i) internal, and (ii) external. The authors provide additional relationships among the distinguished capability types, for example, every external capability must be considered primitive, because it is only the viewpoint of the capability's owner that can enable treating it as composite. From a non-owning organization's viewpoint, it can only be treated as primitive.

- The typology of Arena et al. [19] is another domain-specific study in the combined field of capabilities and risk management. The classification derived from this study consists of the following capability types. Initially, there is the (i) Delivery type, which reflects on an organization's capabilities to execute tasks on an operational level. The second type (ii) Integration and Coordination, reflects on the organization's capabilities that support the Delivery type, along with the coordination of resources for the delivery. The third type, namely, (iii) Learning, concerns capabilities related to generation of new knowledge for the organization, as a means to utilize existing resources more efficiently and effectively. Finally, the last type in this typology is the (iv) Reconfiguration type, which refers to capabilities that enable reconfiguration of existing resources.

- Another typology developed in [30] and reported in [31] concerns the aspects of uniqueness and collectiveness. Uniqueness concerns the degree to which a capability is distinct from the ones owned by competing organizations, and collectiveness reflects on the degree to which a capability is integrated in the entire organization. Both aspects result in classifying capabilities as high or low uniqueness and collectiveness and the combination of these labels results in a quadrant of four capability types. In particular, (i) low collectiveness and uniqueness results in the Business Necessity capability type, (ii) low collectiveness and high uniqueness results in Strategic Support Business capabilities, (iii) high collectiveness and low uniqueness lead to Essential Business capabilities, and (iv) high collectiveness and high uniqueness lead to the Core Business capabilities.

- Finally, a capability typology has been introduced in an earlier work of this paper's author [32, 12] and adjusted for this study. The typology is based on the aspects of purpose and fulfillment status of the capability. That is, the type of organizational intention that is mean to be fulfilled by the capability, and the actual fulfillment status, meaning if the capability is successfully achieving the organization's intentions or not. Based on these two aspects, a quadrant of categories is also produced. A capability successfully achieving a goal is (i) a positive capability, a capability that fails to do so is (ii) and incapability, (iii) a capability that successfully mitigates a problem is referred to as (iii) sustainability, and a capability that fails to mitigate a problem is a liability.

5. A synthesis towards a unified ontology for capability classification

The identified set of typologies has been analyzed and the classification aspects and types have been extracted and combined, as shown in the conceptual model of Fig. 1.

Figure 1: The various capability types that exist in the literature, along with the aspects used for their classification.

The decisions on how the concepts derived from the typologies have been conceptually

linked lies basically in the semantic consistencies, as identified in the papers that introduced the typologies. Figure 1 should not be treated with strict modeling rules as a domain model, but it should be considered as an initial high-level ontological model that can be further expanded in terms of content, semantics, and syntax.

6. Discussion

This paper does not claim to provide an exhaustive inclusion of the entire spectrum of typologies that exist in the literature, yet, the aspiration is that it not only motivates, but also provides a basis for a detailed and thorough elaboration of an ontological description and analysis for business capabilities. In this way, the vague and currently ambiguous area of business capability management, and all that it encompasses, can potentially benefit from a clearer view on the concept based on how it is perceived.

The part of the synthesis that consists of hierarchical aspects includes a significant degree of overlap. This enabled an easier interpretation and integration of the typologies, however, the domain-specific typologies and classifications require additional effort and levels of abstraction for identifying the proper integration points for a solid semantic integration. This is one of the important focal points for future research based on the initial exploration that has been reported in this study.

Defining the concept of capability via an ontological analysis may be perceived as a "reverse engineering" approach, however, it may enable steps forward, towards a commonly acceptable definition of the term. In other words, exploring how researchers and practitioners use and categorize the concept of business capability, has a strong potential to help identify the boundaries of the concept, therefore, it may help establish boundaries that eventually may transform the actual definition and how it is received.

7. Conclusions

The paper uses a wide spectrum of capability typologies and classifications existing in the literature in order to synthesize a "big picture" of perspectives applied on the notion of business capability. The aspiration is that this synthesis will provide a basis for the development of a unified ontology for business capabilities that will improve the current vagueness and diversity existing in the academic and industrial definitions of capability.

References

[1] K. Sandkuhl, J. Stirna, Capability Thinking, in: K. Sandkuhl, J. Stirna (Eds.), Capability Management in Digital Enterprises, Springer International Publishing, Cham, 2018, pp. 1–24. URL: http://link.springer.com/10.1007/978-3-319-90424-5_1. doi:10.1007/978-3-319-90424-5_1.

[2] G. Koutsopoulos, Modeling Organizational Potentials Using the Dynamic Nature of Capabilities, in: Joint Proceedings of the BIR 2018 Short Papers, Workshops and Doctoral

Consortium, volume 2218, CEUR-WS.org, Stockholm, Sweden, 2018, pp. 387–398. URL: http://ceur-ws.org/Vol-2218/paper39.pdf.

[3] D. J. Teece, Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance, Strategic Management Journal 28 (2007) 1319–1350. URL: http://doi.wiley.com/10.1002/smj.640. doi:10.1002/smj.640.

[4] C. E. Helfat, S. G. Winter, Untangling Dynamic and Operational Capabilities: Strategy for the (N)ever-Changing World, Strategic Management Journal 32 (2011) 1243–1250. URL: http://doi.wiley.com/10.1002/smj.955. doi:10.1002/smj.955.

[5] G. Koutsopoulos, M. Henkel, J. Stirna, Conceptualizing Capability Change, in: S. Nurcan, I. Reinhartz-Berger, P. Soffer, J. Zdravkovic (Eds.), Enterprise, Business-Process and Information Systems Modeling, volume 387, Springer International Publishing, Cham, 2020, pp. 269–283. URL: http://link.springer.com/10.1007/978-3-030-49418-6_18. doi:10.1007/978-3-030-49418-6_18.

[6] C. E. Helfat, S. Finkelstein, W. Mitchel, M. Peteraf, H. Singh, D. Teece, S. G. Winter, Dynamic capabilities: understanding strategic change in organizations, Blackwell Pub, Malden, MA, 2007.

[7] D. J. Teece, G. Pisano, A. Shuen, Dynamic capabilities and strategic management, Strategic Management Journal 18 (1997) 509–533. URL: http://doi.wiley.com/10.1002/%28SICI%291097-0266%28199708%2918%3A7%3C509%3A%3AAID-SMJ882%3E3.0.CO%3B2-Z. doi:10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z.

[8] Merriam-Webster, Dynamic, ???? URL: https://www.merriam-webster.com/dictionary/dynamic.

[9] J. Van Riel, G. Poels, A Method for Developing Generic Capability Maps: A Design Science Study in the Professional Sport Industry, Business & Information Systems Engineering 65 (2023) 403–424. URL: https://link.springer.com/10.1007/s12599-023-00793-z. doi:10.1007/s12599-023-00793-z.

[10] D. Beimborn, S. F. Martin, U. Homann, Capability-oriented modeling of the firm, Amalfi, Italy, 2005.

[11] K. Sandkuhl, J. Stirna, A. Persson, M. Wißotzki, Enterprise Modeling: Tackling Business Challenges with the 4EM Method, The Enterprise Engineering Series, Springer, Berlin, Heidelberg, 2014. URL: http://link.springer.com/10.1007/978-3-662-43725-4. doi:10.1007/978-3-662-43725-4.

[12] G. Koutsopoulos, M. Henkel, J. Stirna, Modeling the Phenomenon of Capability Change: The KYKLOS Method, in: D. Karagiannis, M. Lee, K. Hinkelmann, W. Utz (Eds.), Domain-Specific Conceptual Modeling, Springer International Publishing, Cham, 2022, pp. 265–288. URL: https://link.springer.com/10.1007/978-3-030-93547-4_12. doi:10.1007/978-3-030-93547-4_12.

[13] G. Koutsopoulos, Compass: A Canvas for Changing Capabilities, in: T. Clark, S. Zschaler, B. Barn, K. Sandkuhl (Eds.), Proceedings of the Forum at Practice of Enterprise Modeling 2022 (PoEM-Forum 2022), volume 3327 of *CEUR Workshop Proceedings*, CEUR-WS.org, London, United Kingdom, 2023, pp. 66–80. URL: https://ceur-ws.org/Vol-3327/paper07.pdf.

[14] Object Management Group (OMG), Value Delivery Modeling Language v.1.1, 2018. URL: https://www.omg.org/spec/VDML/1.1.

[15] NATO, NATO Architecture Framework v.4, 2018. URL: https://www.nato.int/nato_static_

fl2014/assets/pdf/pdf_2018_08/20180801_180801-ac322-d_2018_0002_naf_final.pdf.

[16] MODAF ontological data exchange mechanism (MODEM), 2012. URL: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/63980/20130117_MODAF_MODEM.pdf.

[17] USA Department of Defense, Department of Defense Architecture Framework 2.02, 2009. URL: https://dodcio.defense.gov/Library/DoD-Architecture-Framework/.

[18] P. Loucopoulos, E. Kavakli, N. Chechina, Requirements Engineering for Cyber Physical Production Systems, in: P. Giorgini, B. Weber (Eds.), Advanced Information Systems Engineering, volume 11483, Springer International Publishing, Cham, 2019, pp. 276–291. URL: http://link.springer.com/10.1007/978-3-030-21290-2_18. doi:10.1007/978-3-030-21290-2_18.

[19] M. Arena, G. Azzone, E. Cagno, G. Ferretti, E. Prunotto, A. Silvestri, P. Trucco, Integrated Risk Management through dynamic capabilities within project-based organizations: The Company Dynamic Response Map, Risk Management 15 (2013) 50–77. URL: http://link.springer.com/10.1057/rm.2012.12. doi:10.1057/rm.2012.12.

[20] P. Loucopoulos, E. Kavakli, Capability Oriented Enterprise Knowledge Modeling: The CODEK Approach, in: D. Karagiannis, H. C. Mayr, J. Mylopoulos (Eds.), Domain-Specific Conceptual Modeling, Springer International Publishing, Cham, 2016, pp. 197–215. URL: http://link.springer.com/10.1007/978-3-319-39417-6_9. doi:10.1007/978-3-319-39417-6_9.

[21] D. Karagiannis, M. Lee, K. Hinkelmann, W. Utz (Eds.), Domain-Specific Conceptual Modeling: Concepts, Methods and ADOxx Tools, Springer International Publishing, Cham, 2022. URL: https://link.springer.com/10.1007/978-3-030-93547-4. doi:10.1007/978-3-030-93547-4.

[22] D. J. Collis, Research Note: How Valuable are Organizational Capabilities?, Strategic Management Journal 15 (1994) 143–152. URL: http://doi.wiley.com/10.1002/smj.4250150910. doi:10.1002/smj.4250150910.

[23] E. Danneels, The dynamics of product innovation and firm competences: The Dynamics of Product Innovation, Strategic Management Journal 23 (2002) 1095–1121. URL: http://doi.wiley.com/10.1002/smj.275. doi:10.1002/smj.275.

[24] S. G. Winter, Understanding dynamic capabilities, Strategic Management Journal 24 (2003) 991–995. URL: http://doi.wiley.com/10.1002/smj.318. doi:10.1002/smj.318.

[25] S. A. Zahra, H. J. Sapienza, P. Davidsson, Entrepreneurship and Dynamic Capabilities: A Review, Model and Research Agenda*, Journal of Management Studies 43 (2006) 917–955. URL: http://doi.wiley.com/10.1111/j.1467-6486.2006.00616.x. doi:10.1111/j.1467-6486.2006.00616.x.

[26] V. Ambrosini, C. Bowman, N. Collier, Dynamic Capabilities: An Exploration of How Firms Renew their Resource Base, British Journal of Management 20 (2009) S9–S24. URL: http://doi.wiley.com/10.1111/j.1467-8551.2008.00610.x. doi:10.1111/j.1467-8551.2008.00610.x.

[27] G. Schreyögg, M. Kliesch-Eberl, How dynamic can organizational capabilities be? Towards a dual-process model of capability dynamization, Strategic Management Journal 28 (2007) 913–933. URL: http://doi.wiley.com/10.1002/smj.613. doi:10.1002/smj.613.

[28] O.-K. Lee, K. Lim, K.-K. Wei, The Roles of Information Technology in Organizational

Capability Building: An IT Capability Perspective, ICIS 2004 Proceedings (2004). URL: https://aisel.aisnet.org/icis2004/53.

[29] A. White, A. Tate, M. Rovatsos, CAMP-BDI: A Pre-emptive Approach for Plan Execution Robustness in Multiagent Systems, in: Q. Chen, P. Torroni, S. Villata, J. Hsu, A. Omicini (Eds.), PRIMA 2015: Principles and Practice of Multi-Agent Systems, volume 9387, Springer International Publishing, Cham, 2015, pp. 65–84. URL: http://link.springer.com/10.1007/978-3-319-25524-8_5. doi:10.1007/978-3-319-25524-8_5.

[30] J. Scott, A. Cullen, M. An, Scott, J., Cullen, A., & An, M. (2010). Building Capability Maps For Business-IT Alignment: A Quick-Start Process Guide, Technical Report, Forrester, 2010.

[31] W. de Wit, Innovating business capabilities diffusing digital transformation strategy into process developments, Master's thesis, TU/e School of Industrial Engineering, Eindhoven, 2016. URL: https://pure.tue.nl/ws/files/46946310/855848-1.pdf.

[32] G. Koutsopoulos, M. Henkel, J. Stirna, Modeling the Dichotomies of Organizational Change: a State-based Capability Typology, in: C. Feltus, P. Johannesson, H. A. Proper (Eds.), Proceedings of the PoEM 2019 Forum, volume 2586 of *CEUR Workshop Proceedings*, CEUR-WS.org, Luxembourg, 2020, pp. 26–39. URL: http://ceur-ws.org/Vol-2586/paper3.pdf.