Dynamic Capabilities and Risk Management: Evaluating the CDRM Model for Clients

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Abstract

Purpose – The purpose of this paper is to examine the Company Dynamic Response Map (CDRM) risk management model that uses the dynamic capabilities concept. The study examines risks associated with strategic decision-making in construction projects and evaluates proposed methods that connect the dynamic capabilities of project-based organisations with risk management.

Design/Methodology/Approach – This preliminary study examines risks associated with strategic decision-making in construction projects and evaluates a proposed model that connects the dynamic capabilities of project-based organisations with risk management. Specifically, the CDRM model is evaluated, a risk management model developed by Arena *et al.* (2013) to better respond to risks and opportunities based on the concept of dynamic capabilities.

Findings – We argue that although the CDRM presents a promising development in that it uses dynamic capabilities prospectively in a risk management model to produce tangible results, there are, nonetheless, impediments to the CDRM being used by construction clients. The primary impediment relates to the issue of categorisation, the difficulty in assigning a specific identified risk to a particular category of dynamic capabilities.

Research Limitations/Implications – A conceptual argument is made and not an empirical one.

Practical Implications – The CDRM model was developed to be used in practice and this paper evaluates that model.

Originality/Value – Contributes to both the dynamic capabilities literature as well as risk management literature. The paper ends with a discussion on the possible merits of the CDRM, and an evaluation on potential impediments to its use by construction clients.

Keywords Client capabilities, Risk management, Construction industry, Dynamic capabilities, Management model, Project organization

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1. Introduction

The construction industry in general, and the construction client in specific, has been criticised for not utilizing risk management to address uncertainties in the industry. Thompson and Perry (1992) mention the large occurrence of deviations from original planning as ample evidence for the inadequate use of risk analysis and management in the

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construction industry. The uncertainties related to construction can be traced back to the complex nature of the construction industry, a line of reasoning that has been written about at great lengths by the likes of Chan and Chan (2004), Raiden and Dainty (2006) and Gann and Salter (2000).

The study presented in this paper sets out to highlight the particular set of risks associated with strategic decision-making in construction projects. Although a considerable amount of research has been dedicated to enumerating the various methods and tools that are available for assessing and managing risks in construction (e.g. Akintoye and MacLeod, 1997; Forbes, *et al.*, 2008; Tah and Carr, 2001), comparatively less research has set out to investigate what might be described as the root problem, i.e. the capability of the construction client to make strategic decisions that are risk-aware in character. An early attempt to explain how capabilities emerge in firms was that of Nelson and Winter (1982) who regarded firms as bundles of path-dependent knowledge bases wherein capabilities could emerge through the repetitive processes of "learning by doing" found embedded in organisational routines. This concept has been expanded upon by the likes of Cohen and Levinthal (1990), Teece *et al.*, (1997) who introduced the term "dynamic capabilities" and Zollo and Winter (2002) who emphasised the learning mechanisms of dynamic capabilities. The term "dynamic capabilities" here refers to the organisation's ability to build, integrate or reconfigure its resources to adapt to external changes in the environment (Teece *et al.*, 1997).

In this paper, we review risk management in construction, particularly with respect to the dynamic capabilities of the client organisation. In doing so, we examine the CDRM model developed by Arena *et al.*, (2013), which represents a novel tool for construction organisations to use to manage their dynamic capabilities from a risk management perspective.

This paper does *not* seek to validate the CDRM model given a case but *rather to examine the theoretical limitations* of the CDRM model, specifically as it relates to client organisations. In doing so, this paper can be considered part of an ongoing study that serves as a precursor to a potential upcoming study that applies the CDRM model in specific cases involving client organisations to evaluate the model's efficacy. The reason for studying the construction clients' challenges through an approach that uses dynamic capabilities is primarily because it provides a means by which we can examine the development of organisations from a strategic perspective, specifically as that development relates to how these organisations can deploy their capabilities to enact changes that are congruent with their changing environments (Adam and Lindahl, 2017; Adam *et al.*, 2015).

2. Assessing risks in construction

Although risk is a somewhat multi-layered concept, in a construction context, it typically refers to the likelihood of a detrimental event/factor occurring during the lifespan of a construction project (Wang *et al.*, 2004). Accordingly, risk management is concerned with the identification of risks and the execution of plans aimed at minimizing, sharing, transferring, or accepting those risks (Jergeas and Put, 2001).

When assessing these risks, Hopkinson (2012) stresses the importance of not relying on a single risk management tool and warns that the common approach of applying the same risk management method to every new project is contrary to best practices. Instead, Hopkinson (2012) insists that best practices would entail the intelligent application of principles and the selection of appropriate techniques to each individual project. Traditionally, quantitative methods for risk analysis have constituted the dominant paradigm for assessing and managing risks. However, owing to the inherent subjectivity that is integral to risk management and the biases that result therein, mounting dissatisfaction has fuelled research into different approaches to handling risk (Tah and Carr, 2001).

In particular, the allocation that occurs of the probabilities of occurrence in each of the variables included in the risk analysis is by its very nature subjective (Thompson and Perry, 1992). An important issue is the communication of construction projects risks which tends to be poorly delivered, incomplete in its delivery and thoroughly inconsistent. Consequently, the various contributors to the construction project lack the necessary shared understanding of risks and are, therefore, unable to enact any effective early warning measures or strategies for mitigating risks that stem from problems rooted in decisions taken elsewhere in the organisational structure (Tah and Carr, 2001). Furthermore, as Kutsch and Hall (2010) point out that a large share of the research on risk management in projects focuses on developing methods for conducting risk analysis, whereas relatively few studies evaluate the effectiveness of said methods. Nonetheless, Shenhar *et al.* (1996) establish that there is a striking need for risk management procedures, a need that is greater the more sizable and complex the project becomes.

3. Integrating dynamic capabilities and risk management

In this section, a specific tool is described (CDRM) developed by Arena *et al.* (2013), that seeks to bridge dynamic capabilities with risk management. The purpose thereof is to provide a more comprehensive view of risk management that enables construction organisations to use their resources to adapt to external changes in the environment.

The CDRM was developed by Arena *et al.* (2013), with the aim to either complement or substitute conventional monitoring systems that are founded on risk registers, and to instead recreate a "dynamic representation of the risk response strategies and risk treatment mechanisms adopted by the organization" (*ibid.* p. 54). The research literature tends to perceive risk management as a tool that deals with unanticipated events at either a project or portfolio level, often by using a contingency approach (PMI, 2004). Arena *et al.* (2013) argue that much less attention has been paid to integrate risk management across different organisational levels (enterprise, portfolio and projects) to support the decision-making process. Their paper seeks to present an integrated approach, a tool (CDRM) that helps project-based organisations to adopt a holistic and integrated perspective when managing risks.

The CDRM is represented graphically by a matrix that portrays risk portfolio characteristics and associated risk response strategies into four quadrants (Please see CDRM Model, Numerical Values are Gathered from an Example (Arena *et al.*, 2013). The first quadrant (upper right) illustrates the relationship between risk categories, conventionally represented as ROBS, which is defined as risk and opportunity breakdown structure, and their aggregated financial impacts. In the x-axis, the categories of the ROBS are ordered in line with the project value change (i.e. engineering, procurement, construction, execution), while the final elements (contract, client, external environment, HSE; economical) represent external organisations. Thus, the first quadrant shows the risk categories to which higher risks and opportunities are related, both with respect to their financial impact (y-axis) as well as in terms of the frequency of occurrences (as illustrated by the size of the circle), thereby pinpointing areas that are most critical. The second quadrant (upper left) shows the average impacts of risks to the organisational levels where they are dealt with (enterprise, functions, portfolio and projects). The x-axis in the second quadrant represents the different organisational levels (ordered to the size of the levels), whereas the y-axis shows the average financial impacts. The remaining two quadrants deal with the organisation's response, identified by different macro-capabilities.

The four types of macro-capabilities that are identified are i) delivery, ii) integration & coordination, iii) learning and iv) reconfiguration. These are based on Teece *et al.*'s (1997) conceptualisation of dynamic capabilities. These macro-capabilities (different dynamic capabilities clustered together in the four types mentioned previously) are used to exploit resources in response to changes in the external environment. The third quadrant (bottom left) illustrates how macro-capabilities are used at various organisational levels, thereby supporting the organisation in identifying strategies at the various levels (enterprise, portfolio, etc.). The y-axis in the third quadrant represents the categories of the macro-capabilities, whereas the x-axis represents the organisational level where the risks are managed. The fourth and final quadrant illustrates the relationship between various categories of ROBS and the macro-capabilities that are used to manage them to enable the identification of possible links between particular risk response strategies and certain types of risks. The numerical values that are shown represent values that were obtained from a study that Arena *et al.* (2013) conducted with a construction company.

The matrix has been completed with the result of an example, showing 826 identified risks that were reported into the studied organisation's risk register between 2005 and 2010. The first quadrant shows that the 826 risks have a potential financial impact of 3.2 billion USD. The second quadrant illustrates the average impacts of the risks as 3.6, 6.8, and 2.2 million USD at project, function and portfolio level, respectively. By means of 105 identified capabilities, these risks are managed at the different levels with the highest frequencies being related to delivery (59) and integration (33), as shown in Quadrant Four. Looking at the macro-capability related to Delivery, the 59 corresponding capabilities were mostly used at project level; in only a select number of cases had the risk treatment been enacted at higher organisational levels, as shown in Quadrant Three.

4. Evaluation of the applicability of the CDRM model

Risk is an inevitable part of construction; the focus is not whether it can be eliminated but whether one can find ways to minimise its occurrence or reduce its severity (Kangari, 1995). This paper has described the need for risk management in construction and then discussed different approaches that had been taken in terms of risk management. One such approach is the CDRM model developed by Arena et al. (2013) which seems promising because it provides a tool for managers to think about dynamic capabilities prospectively, and as a managerial tool, the CDRM enables operational and strategic decision-making. This addresses the issue of dynamic capabilities not being able to provide prescriptive guidance. By utilizing dynamic capabilities in a risk management tool such as the CDRM, Arena et al. (2013) provide a means by which organisations can identify different risk response strategies (in terms of macro-capabilities/dynamic capabilities) with the purpose of supporting operational and strategic decision-making.

However, although the development of CDRM seems promising, there are nonetheless a number of possible impediments that we have identified that may hinder its use by public construction clients. The discussion below highlights some of these possible impediments:

Impediment 1: *Lack of a rigid process for classifying which dynamic capabilities can be associated with a particular risk*

The challenge of categorizing data is a well-known challenge in qualitative research. Unlike in qualitative sciences, were numerous methods for categorisation of data has been developed (e.g. factor analysis (*cf.* Nunnally and Bernstein, 1994) and cluster analysis (*cf.* Aldenderfer and Blashfield, 1984), for qualitative research, no generalizable and reliable methods seems to exist for categorizing data (Larsen and Monarchi, 2004). The challenge with this is that it creates opportunities for the one conducting the categorisation to do so without any rationale as to why a particular observed data belongs to category "x" instead of category "y". Gordon (1999, p. 183) acknowledges the challenge by stating:

> "there were claims that the main criteria for assessing a [categorisation] were its interpretability and usefulness. There are clearly dangers in such an approach: the human brain is quite capable of providing post hoc justifications of results of dubious validity"

Arena *et al.* (2013) address this issue by stating that the categorisation of a particular risk with one of the macro capabilities was performed independently by two groups of researchers. They further go on to explain that in cases where there were dissenting views regarding which risk that belonged to which category, they would compare the different classifications performed by the researchers and the competing interpretations on which specific risk should be associated with a specific macro-capability were discussed. If no consensus was reached for one of the competing interpretations, they would conduct follow-up interviews with key actors in the studied case (specifically, with project managers, risk managers and internal auditors). Although the methodology used by Arena *et al.* (2013) for classifying risks provides a viable approach for researchers studying a specific case, it does not seem to give practitioners (for whom the CDRM was developed) any instructions as to how to conduct these categorisations systematically. At the very least, CDRM would need to contain a set of rules to determine the hierarchy of the risks that have been identified. An example of how principles for hierarchical categorisation could look like is presented by Richards and Richards (1995, pp. 87-89) who formulated three principles with regards to hierarchical categorisation:

(1) "The children of a category should be cases in the same sense of the parent.
(2) The description of a given category should apply to all the categories in the subtree below it. The subcategories in a tree should not switch partway down; that is, they must remain generic with respect to the higher categories.
(3) One topic or idea should occur in only one place in the index system."

By not having in place any principles for how the categorisation should be made, the results obtained from CDRM risks losing reliability in terms of not being able to produce similar results if a different individual uses the same data. This would also impede any efforts to benchmark or compare different results obtained from the CDRM with other previous CDRM results.

Impediment 2: *CDRM developed from a contractor's perspective, not the client organisation*

Because the CDRM is developed from a contractor organisation's perspective, it is not entirely clear if the results obtained therein are applicable to public clients. We would argue that this would not seem to constitute a major challenge as the categorisations that they use and the risk types they identify seem to be nearly identical for construction clients. Furthermore, in the past, risk management models that have been developed from the point of view of the contractor have often been used by client organisations as well, without major concerns. However, there is, nonetheless, a need for testing the CDRM from a client perspective to examine whether it can produce any useful results.

Impediment 3: *CDRM has not yet been tested on a wider scale*

Arena *et al.* (2013) mention that their research was based on a singular, albeit longitudinal, study and that their results have not been tested outside of that one case. Although there is nothing erroneous in developing their model based on a singular case (Platt, 1992), further studies are necessary to determine if their results can be extrapolated to a wider context. By testing the CDRM in different organisations, it may be possible to ascertain if the model can produce results that are comparable from one organisation to another.

Although there are certain possible impediments that may hinder CDRM from being used by public construction clients, it, nonetheless, serves as an important advancement in taking an abstract concept such as a "dynamic capability" and assigning it testable values in a risk management model.

5. Conclusions

The construction process is, as is conventionally understood by both researchers and practitioners, embedded with hazards and risks. The risks entailed in everyday work in both design and production are affected by the fragmentation between specialists, control by authorities and an absence of business drivers executed on an operative level.

As mentioned previously, the dynamic capabilities concept as perceived by Teece *et al.* (1997) does not provide prescriptive guidance. There have been recent efforts, however, that seeks to use the "dynamic capabilities" term and apply it prospectively. In this paper, we examined one such effort, the CDRM, a risk management model based on dynamic capabilities, which identifies risks and opportunities and connects them with the response strategies of the organisation (in terms of dynamic capabilities that have been grouped into what Arena *et al.* [2013] refer to as macro-capabilities). We argue that there needs to be a delineation of the principles that are used for producing hierarchical categorisation. There is quite clearly a qualitative aspect to risk management, both in terms of identifying specific risks but also in terms of categorizing these risks with respect to specific responses. Although the CDRM presents a novel and promising model that fuses dynamic capabilities research with risk management research, it, nonetheless, needs to be further explicated, specifically with respect to how the qualitative assessment of pairing a specific risk with a specific macro-capability can be made in reliable way.

What is lacking in dynamic capabilities research, and which future research might address, is the development of a formal theory which more explicitly connects the precise antecedents that generate dynamic capabilities for construction clients. A substantive theory is considered transferable as opposed to generalizable (Dwivedi, 2009). This means that certain elements of that theory can be transferred to other similar contexts. This would contrast with a formal theory in which it would be possible to extrapolate the given results with conclusions that are based on validated, generalizable statements derived from multiple studies representing the research population as a whole (Fook, 2002). By having a more tangible description of dynamic capabilities, future studies might shed greater light on ways to not merely *describe* risk management with respect to dynamic capabilities but instead provide means by which we can measurably *reduce* risks associated with construction by utilizing the construction organisations' internal resources in a way that is congruent with the changing dynamic environment.

References

Adam, A. & Lindahl, G. (2017), "Applying the dynamic capabilities framework in the case of a large public construction client", *Construction Management and Economics*, Vol. 35, No. 7, pp. 420–431.

Adam, A., Lindahl, G. and Josephson, P. E. (2015), "Developing capabilities for public construction clients", *in Proceedings of the 19th International Symposium on Advancement of Construction Management and Real Estate, 2015,* Springer, Berlin, Heidelberg, pp. 737–745.

Akintoye, A. S. and MacLeod, M. J. (1997), "Risk analysis and management in construction", *International Journal of Project Management*, Vol. 15, No. 1, pp. 31–38.

Aldenderfer, M. and Blashfield, R. (1984), *Cluster Analysis*. Sage Publications, Newbury Park, US.

Arena, M., Azzone, G., Cagno, E., Ferretti, G., Prunotto, E., Silvestri, A., & Trucco, P. (2013). "Integrated risk management through dynamic capabilities within project-based organizations: the company dynamic response map", *Risk Management*, Vol. 15, No. 1, pp. 50–77.

Chan, A. P. and Chan, A. P. (2004), "Key performance indicators for measuring construction success", *Benchmarking: An International Journal*, Vol. 11, No. 2, pp. 203–221.

Cohen, W. M. and Levinthal, D. A. (1990), "Absorptive Capacity: A New Perspective on Learning and Innovation", *Administrative Science Quarterly*, Vol. 35, No. 1, pp. 128–152.

Dwivedi, Y. (2009), *Handbook of research on contemporary theoretical models in information systems*: IGI Global.

Fook, J. (2002), "Theorizing from practice: Towards an inclusive approach for social work research", *Qualitative Social Work*, Vol. 1, No. 1, pp. 79–95.

Forbes, D., Smith, S. and Horner, M. (2008), "Tools for selecting appropriate risk management techniques in the built environment", *Construction Management and Economics*, Vol. 26, No. 11, pp. 1,241-1,250.

Gann, D. M. and Salter, A. J. (2000), "Innovation in project-based, service-enhanced firms: the construction of complex products and systems", *Research policy*, Vol. 29, No. 7, pp. 955–972.

Gordon, A. (1999), *Classification*. Chapman & Hall/CRC, Boca Raton, US.

Hopkinson, M. M. (2012), *The project risk maturity model: Measuring and improving risk management capability*. Farnham, UK: Gower Publishing, Ltd.

Jergeas, G. & Put, J. V. D. (2001), "Benefits of constructability on construction projects", *Journal of Construction Engineering and Management*, Vol. 127, No. 4, pp. 281–290.

Kangari, R. (1995), "Risk Management Perceptions and Trends of U.S. Construction", *Journal of Construction Engineering & Management*, Vol. 121, No. 4, pp. 422–429.

Kutsch, E. and Hall, M. (2010), "Deliberate ignorance in project risk management", *International Journal of Project Management*, Vol. 28, No. 3, pp. 245–255.

Larsen, K. and Monarchi, D. (2004), "A Mathematical Approach to Categorization and Labeling of Qualitative Data: The Latent Categorization Method", *Sociological methodology*, Vol. 34, No. 1, pp. 349–392.

Nelson, R. and Winter, S. (1982), *An Evolutionary Theory of Economic Change*. Belknap Press, Cambridge, US.

Nunnally, J. and Bernstein, I. (1994), *Psychometric Theory*. New York, US.

Platt, J. (1992), "Case study in American methodological thought". *Current Sociology*, Vol. 40, No. 1, pp. 17–48.

PMI. (2004), *Project Management Body of Knowledge Guide Book*, Project Management Institute, Newtown Square, US.

Raidén, A. B. and Dainty, A. R. (2006), "Human resource development in construction organisations: An example of a "chaordic" learning organisation?", *The Learning Organization*, Vol. 13, No. 1, pp. 63–79.

Richards, T. and Richards, L. (1995), *Using Hierarchical Categories in Qualitative Data Analysis*. *In: U. Kelle, ed. Computer-Aided Qualitative Data Analysis: Theory, Methods and Practice*. Sage Publications, London, UK, pp. 80–95.

Shenhar, A. J. and Dvir, D. (1996), "Toward a typological theory of project management", *Research policy*, Vol. 25, No. 4, pp. 607–632.

Tah, J. H. M. and Carr, V. (2001), "Knowledge-based approach to construction project risk management", *Journal of Computing in Civil Engineering*, Vol. 15, No. 3, pp. 170–177.

Teece, D. J., Pisano, G. and Shuen, A. (1997), "Dynamic Capabilities and Strategic Management", *Strategic Management Journal*, Vol. 18, No. 7, pp. 509–533.

Thompson, P. and Perry, J. G. (1992). *Engineering construction risks: A guide to project risk analysis and assessment implications for project clients and project managers*. Thomas Telford Publishing, London, UK.

Wang, S. Q., Dulaimi, M. F. and Aguria, M. Y. (2004), "Risk management framework for construction projects in developing countries", *Construction Management and Economics*, Vol. 22, No. 3, pp. 237–252.

Zollo, M. and Winter, S. G. (2002), "Deliberate learning and the evolution of dynamic capabilities", *Organization science*, Vol. 13, No. 3, pp. 339–351.