

Absorptive Capacity in Construction SMEs: A Literature Synthesis

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Abstract: Rapid technological changes and increasing global competition are challenging the construction industry. Construction organizations can no longer rely on internal sources to generate new knowledge and technology. The ability to acquire, assimilate, transform and exploit external sources of knowledge and technology are critical components for organizations to survive, grow and compete in the market. This ability is called absorptive capacity. Many researchers have explored absorptive capacity in studies at different levels: individuals, organizations, industry and country. However, most of the studies focus on very large organisations, which have sophisticated structures and strong R&D orientations. Very few studies address absorptive capacity in SME organizations. This paper presents a literature synthesis on absorptive capacity, focussing on SME construction organizations. This paper contributes to the body of knowledge of absorptive capacity by providing relevant literature synthesis in the area and because of the gaps found in the literature, this paper raises questions for further research.

Key words: Absorptive Capacity • Construction organization • SME

INTRODUCTION

The construction industry has become more challenging. Clients' changing needs, increasingly complex projects, more efficient construction methods and strong competition in the industry have created strong demand for advanced and new construction technologies. Technological development has changed the production process and implementing new technology on-site has become more important in achieving increased efficiency. However, technological development comes with cost and risks. With rapid technological changes, short product life-cycles and increasing global competition, an organization can no longer rely entirely on its internal sources to generate new knowledge and technology. Acquiring new technology from external sources has become crucial, to enable organizations to cope with the pace of technological development [1]. Thus, absorptive capacity has been acknowledged as one of the fundamental components for organisations to survive, grow and compete in the market.

This paper presents a literature synthesis on absorptive capacity, focusing on SME construction organizations. The aim of this paper is to contribute to

this underdeveloped area of research, by providing a relevant literature synthesis. From the gaps in the current literature, this paper raises questions for further research. The first section of this paper discusses the theoretical background of absorptive capacity. The second section presents a literature synthesis of absorptive capacity in SME construction organisations and proposes key issues for future research. The last section includes a conclusion from the literature synthesis.

Concept of Absorptive Capacity: Several studies have been carried out applying the concept of absorptive capacity, i.e. in manufacturing firms [1, 2], innovation and new product development [3, 4], information technology and multimedia [5-7], knowledge management and organizational learning [8-10].

The concept of absorptive capacity originates from macroeconomics, where it refers to the ability of an economy to use its capital resources effectively [11]. Cohen and Levinthal [2] An organisation's absorptive capacity is its ability to recognize the value of new information, to assimilate that information and apply it to further its commercial ends. Mowery and Oxley [12] suggest that absorptive capacity is the ability to

Table 1: Definitions of absorptive capacity

Author(s)	Definition
Adler [11]	Ability of an economy to utilize its capital resources effectively
Cohen and Levinthal [2]	Ability to recognize the value of new information, assimilate it and apply it to commercial ends
Mowery and Oxley [12]	Ability to understand the external source of technology and apply it internally.
Lane and Lubatkin [8]	Ability to learn from another firm
Zahra and George [9]	A set of organizational routines and processes, by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability.
Liao, Wu [13]	Organisation's ability to absorb external knowledge
Kamal and Flanagan [14]	Ability to acquire, learn, understand and make use of new resources, to improve performance
Ndiege, Herselman [15]	Learning ability that organizations develop to identify the external information and knowledge that is important to them and customize it to meet their specific needs.

understand the external source of technology and apply it internally. They suggest that in absorptive capacity a broad set of skills is needed, to deal with the tacit component of the transferred technology, as well as to cope with the necessity of transforming the imported technology for domestic application'

Zahra and George [9] proposed a comprehensive concept of absorptive capacity, in which they described absorptive capacity as a set of organizational routines and processes, by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability. Their definition, gives absorptive capacity into four organisational / individual capabilities involving:

- Acquisition – a firm's capability in identifying and acquiring the external knowledge that is important to its operation.
- Assimilation - a firm's capability in processing, analysing, interpreting and understanding the information and knowledge acquired from external sources.
- Transformation - a firm's capability in combining acquired knowledge with existing knowledge, by adding knowledge, discarding unnecessary knowledge or interpreting the same knowledge in a different manner and;
- Exploitation - a firm's capability in applying acquired or transformed knowledge into their operations.

Zahra and George [9] described the first two as potential absorptive capacity; reflecting the organisation's receptiveness towards new external knowledge. Transformation and exploitation of knowledge are categorized as realized absorptive capacity; reflecting the organisation's ability to leverage the knowledge. All these subsets of absorptive capacity, regardless of whether it is potential absorptive capacity or realized

absorptive capacity, co-exist at all times to improve an organisation's performance [9]. For example, organisations cannot exploit knowledge without first acquiring it and similarly, an organisation's ability to acquire and assimilate external knowledge does not guarantee that it will exploit this knowledge. Table 1 provides some of definitions of absorptive capacity.

Based on various definitions of absorptive capacity, it is clear that absorptive capacity is a multi-dimensional concept that has been studied in many disciplines, with different perspectives across a myriad of fields. There are similarities in the literature, in which absorptive capacity involved a sequence of processes, starting from the recognition of new information/knowledge to the implementation of it. In relation to information/knowledge application, Cohen and Levinthal [2] suggest that an organisation's absorptive capacity is dependent on the absorptive capacities of its individual members. However, there are other aspects of absorptive capacity that are particularly related to organisations; of which the combined absorptive capacities of its employees is merely one. Absorptive capacity is a multilevel concept occurring at individual, organisational, industry and national levels.

At the individual level, many researchers proposed that absorptive capacity is linked to prior related knowledge and the experience of individuals. Accumulated prior knowledge is seen as increasing an individual's ability to acquire new knowledge and, at the same time, increasing their ability to recall and use their own knowledge [2]. Bower and Hilgard [16] suggest that a breadth of prior knowledge will enhance individual learning, because with more knowledge stored in his or her memory, the more readily an individual can establish links with new related knowledge and, in turn, acquire new knowledge. Gray [17] found that relevant background knowledge, developed through education and experiences of individuals, has a positive link with the development of absorptive capacity.

Table 2: Research related to absorptive capacity at different level

Level of Absorptive Capacity	Author(s)
Individual	Bower and Hilgard [16]; Cohen and Levinthal [2];Deng, Doll [7], [21]; Lenox and King [22]
Organisation	Cohen and Levinthal [2]; Bosch, Volberda [5], [8, 10]; Lin, Tan [1]; Smallbone, North [4]
Industry	Rawski (1975); Liao, Wu [13]; Abecassis-Moedas and Mahmoud-Jouini [3]; Stock, Greis [6]
National/Country	Kim [23]; Hou and Gee [24]

However, an individual’s accomplishment, in acquiring new knowledge, does not imply that he/she managed to utilize the acquired new knowledge. Krogh and Roos [18] suggest that, when an individual’s performance of tasks is interrupted by the appearance of a problem, they are pushed to apply the knowledge they have gained in solving the problem. Koskinen and Vanharanta [19] agree that the depth of knowledge and multi-faceted experiences that they refer to as “know-how”, will also increase the possibility that individuals will solve problems, especially when the problem involves difficult technological issues. Koskinen and Vanharanta [19] further suggest that action learning is one way that individuals acquire and absorb new knowledge. Through action learning, individuals learn from one another by mutual support, advice and questioning, using both explicit knowledge, accessed from formal sources, such as books, reports, database, magazines and websites, together with tacit knowledge, gained through experience, as they work on real issues or practical problems, while carrying out real responsibilities in real conditions.

At the organisational level, Cohen & Levinthal [2] suggest that an organisation with higher levels of absorptive capacity tends to be more proactive in exploiting opportunities in the environment. They are able to react promptly to client requirements, market needs and can renew their products regularly in order to compete. Similar to the individual development of absorptive capacity, relevant background knowledge is important to help to increase the organisation’s capabilities to assimilate and exploit new knowledge. Researchers [2, 4, 8, 12] suggest that investment in R&D is one effective way for an organisation to build its background knowledge and absorptive capacity. Organisations may conduct their basic research and development in-house to provide their own general background knowledge.

Gann [20] suggests that collaboration in university research is one way for an organisation to build its background knowledge and absorb external sources of knowledge. He described professional institutions as having played an important role in the development and dissemination of knowledge. At the same time, technology transfers, such as licensing, joint ventures or direct transfers, to a wholly-owned subsidiary

company are proposed as alternatives for organisations to develop their background knowledge and absorptive capacity [12].

An organisation’s process of absorbing external knowledge and the transfer of knowledge across and within sub-units in the organisation, are important aspects of organisational absorptive capacity [2]. Cohen & Levinthal [2] suggest organisations should have a ‘gatekeeper’, a specialized individual acting as the communication link between the organisation and the external environment and also between sub-units within the organisation. The main function of a ‘gatekeeper’ is to monitor the environment and translate complex external knowledge into a form which is understandable by the internal staff. However, under conditions of rapid and uncertain technical change, relying wholly on the ‘gatekeeper’ in transmitting the external knowledge is not sufficient. The internal staff, as a whole, must have some level of relevant background knowledge, to have effective communication and interaction across and within the sub-unit. Table 2 below summarizes research related to absorptive capacity at different levels.

Based on the literature, absorptive capacity is characterized as heterogeneous. Different individuals and organizations have different levels of competencies to learn and understand new things. In SME organisations, absorptive capacity occurs by different means. The next section analyses the literature on absorptive capacity in the context of SME organisation.

Absorptive Capacity in SME Construction Organisation:

Most of the studies on absorptive capacity focus on large organisations, which have sophisticated structures and are R&D orientated. The Research and literature on absorptive capacity, related to SMEs, mostly concentrate on those growth orientated and high technology small firms, which consider R&D activities as the core measurement of absorptive capacity. For example, Liao, Welsch [25] suggest development of absorptive capacity on growth-orientated SMEs allows them to better appreciate, understand and evaluate environmental changes and those SMEs with higher levels of absorptive capacity tend to be more proactive and responsive. Kodama [26] found that the absorptive capacity of

product-developing SMEs is the key element of an efficient regional technology transfer system between universities, industry and firms in Japan. Kodama [26] also suggests that a higher absorptive capacity of product-developing SMEs can be gauged from their higher level of investment in R&D. However, he admits that it is not easy to find small firms with necessary absorptive capacity, especially in rural regions. The findings by Jong and Freel [27] also reflect the importance of R&D in high levels of absorptive capacity in high technology small firms. Jong and Freel [27] found that small firms with high absorptive capacity have higher R&D expenditures and are more likely to have innovation related collaboration with outside organizations. There is little research on absorptive capacity relating to SMEs operating in the conventional manner, with no R&D activities. There is also no tangible measurement of how to identify and measure absorptive capacity outside the R&D context. outside of the R&D context' Muscio [28] proposed a human resource approach, such as using education, skills and training as indicators for absorptive capacity in conventional SMEs. He agrees that alternative components of firms' learning processes, such as learning by doing and learning by using, are key roles in developing knowledge and generating absorptive capacity in SMEs. There are significant differences between large companies, growth orientated and high technology SMEs and traditional/conventional SMEs in their ability to absorb new knowledge.

Research on absorptive capacity in the SME construction organization context is still ambiguous. The theory and process of absorptive capacity is drawn from other industries i.e. manufacturing, management and technology. The process in which SME construction organizations develop their absorptive capacity is one of the limitations in the literature. The studies by Gray [17] and Barrett *et al* [29] suggest that performance improvement, based on new knowledge absorbed into construction SMEs, through technology transfer can and does, occur successfully, but in a different way to that in large enterprises. Walker, Maqsood [30] suggests that a strong absorptive capacity in a construction organisation will help to synchronize people's capabilities, processes and technologies, as the integration between these three organizational components will contribute towards organization productivity. However, construction organisations are different from many types of organization, as they are project driven and involve a wide range of participants. The effort to synchronize people's capabilities, the technologies, process involved and the

flow of knowledge may be relevant at the initial stages, which involve planning, design and scheduling. However, when it comes to on-site projects, the development of absorptive capacity is difficult to define and the three important components may segregate as each project involves different processes and requires different sets of skills and technology. The individuals, engaged in the process, have a variety of background knowledge and different competency levels. There are huge differences between individual capabilities to absorb new knowledge. Most individuals at higher levels, such as designers (architects) and engineers, have a strong background education in their own field and a proper background knowledge of and a familiarity with, the overall construction process, their speed and capability to absorb new knowledge is high. However, most individuals at the lower levels, especially the on-site labour, who have low education levels and little, or no, proper background knowledge of construction, are less capable of absorbing new knowledge and are slower to do so. At the same time, a particular project team may only work together for one project and they are likely to move from one project to another. Therefore, in construction organisations, especially in the project phase, the knowledge absorption process is more complex, as it involves different people, with some knowledge input moving around from one project to another, different kinds of technologies and different processes at every stage.

Spithoven *et al* [31] suggest that small firms operating in traditional sectors, such as construction, typically exhibit limited in-house absorptive capacity and need assistance from research centres i.e. university and public research centres to help them in building absorptive capacity. However, earlier research by Gann [20] revealed most small construction firms do not have sufficient infrastructure or internal resources to acquire and use the research results produced by universities. Only a few construction firms have the capability to absorb and act directly upon academic research results. These firms already had a track record of collaboration with university researchers and have their own technical support infrastructure, to assist them in the learning process between projects. With regard to joint ventures and partnering, as a medium for organisations to absorb new knowledge, a similar problem occurs among the construction SMEs. It is very difficult for them to compete and secure a joint venture or partnering with well-known or international construction companies, because most well-known construction companies would be more confident in working, with large construction companies to protect their business interests.

Case studies by Kamal and Flanagan [14] reflect the issue faced by the construction SMEs operating in rural areas, they found that absorptive capacity of SMEs in rural areas is very much influenced by their characteristics and external environment. The rural organization usually has no specific policy or aim towards the development of human resources and its absorptive capacity. It depends on individuals (the staff) and on how they acquire new knowledge and how they develop their personal absorptive capacity. Ndiege, Herselman [15] described, that due to their small size and resource constraints, small enterprises are expected to have a lack of awareness of the relevance of absorptive capacity and no sound understanding of the processes of knowledge acquisition, assimilation, transformation and exploitation. They tend to practice elements of absorptive capacity in an ad-hoc manner and they relegate such ventures to the category of a luxury, with most preferring to adopt a 'wait and see' approach [15].

Based on reviewing the literature and discussion on absorptive capacity in SME organizations, it appears that there is scarce consideration of process and measurement of absorptive capacity, in construction organizations, in particular SME construction organizations. From the gap in the literature, this paper raises the following questions for future research:

- How do SME construction organizations develop their absorptive capacity?
- Are the processes of knowledge acquisition, assimilation, transformation and exploitation relevant/existing in SME construction organizations?;
- How to measure absorptive capacity in SME construction organization?

CONCLUSION

Absorptive capacity is the function of prior related knowledge and experience. It is the process that involves the ability of individuals/organisations to acquire, assimilate, transform and use external sources of knowledge to improve performance and productivity. Absorptive capacity, by its nature, is heterogeneous. It is crucially important for organisations to gain and keep a competitive advantage. Absorptive capacity in a construction organisation is complex, due to the characteristics of the industry, in that it is fragmented with long supply chains and the separation between design and production processes. It deals with high value items, where each project is unique, being designed and built by

temporary project teams. Absorptive capacities across the industry occur at many different levels, ranging from manufacturers with research and development facilities to small enterprises, working as sub-contractors. To date, there is no valid way to measure absorptive capacity in SME organizations and there is a gap in understanding how absorptive capacity occurs in SME organizations, whether the process of knowledge acquisition, assimilation, transformation and exploitation exists, or there is a different way to understand it. The research questions raised in this paper, through the literature review conducted, could be a basis for future research related to absorptive capacity.

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REFERENCES

1. Lin, C., B. Tan and S. Chang, 2002. The Critical Factors for Technology Absorptive Capacity. *Industrial Management and Data Systems*, 102(6): 300-308.
2. Cohen, W.M. and D.A. Levinthal, 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35: 128-152.
3. Abecassis-Moedas, C. and S.B. Mahmoud-Jouini, 2008. Absorptive Capacity and Source-Recipient Complementarity in Designing New Products: An Empirical Derived Framework *The Journal of Product Innovation Management*, 25: 473-490.
4. Smallbone, D., D. North and R. Leigh, The growth and survival of mature manufacturing SMEs in the 1980s: an urban-rural comparison, in *Small Firms in Urban and Rural Locations*, J. Curran and D. Storey, Editors. 1993, Routledge: London. pp: 79-131.
5. Bosch, F.A.J.V.D., H.W. Volberda and M.D. Boer, 1999. Coevolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Forms and Combinative Capabilities. *Organization Science*, 10(5): 551-568.
6. Stock, G.N., N.P. Greis and W.A. Fisher, 201. Absorptive Capacity and New Product Development. *Journal of High Technology Management Research*, 12: 77-91.

7. Deng, X., W.J. Doll and M. Cao, 2008. Exploring the absorptive capacity to innovation/productivity link for individual engineers engaged in IT enabled work Information & Management, 45: 75-87.
8. Lane, P.J. and M. Lubatkin, 1998. Relative absorptive capacity and interorganizational learning. Strategic Management Journal, 19: 461-477.
9. Zahra, S.A. and G. George, 2002. Absorptive Capacity: A Review, Reconceptualization and Extension. Academy of Management Review, 27(2): 185-203.
10. Kuznetsov, A. and H. Yakavenka, 2005. Barriers to the absorption of management knowledge in Belarus. Journal of Managerial Psychology, 20(7): 566-577.
11. Adler, J.H., 1995. Absorptive Capacity: The Concept and Its Determinants 1965, Washington D.C: The Brookings Institution.
12. Mowery, D.C. and J.E. Oxley, 1995. Inward Technology Transfer and Competitiveness: The Role of National Innovation Systems. Cambridge Journal of Economics, 19: 67-93.
13. Liao, S.H., *et al.*, 2009. Knowledge Acquisition, Absorptive Capacity and Innovation Capability: An Empirical Study of Taiwan's Knowledge-Intensive Industries. World Academy of Science, Engineering and Technology, 53: 160-167.
14. Kamal, E.M. and R. Flanagan, 2012. Understanding Absorptive Capacity in Malaysian Small and Medium Sized (SME) Construction Companies Journal of Engineering, Design and Technology, 10(2): 180-198.
15. Ndiege, J.R., M.E. Herselman and S.V. Flowerday, 2012. Absorptive Capacity: Relevancy for Large and Small Enterprise. SA Journal of Information Management, 14(1): 1-9.
16. Bower, G.H. and E.R. Hilgard, 1981. Theories of Learning 5th Edition 5th Edition ed1981, Englewood Cliffs, N.J: Prentice-Hall.
17. Gray, C., 2006. Absorptive Capacity, knowledge management and innovation in entrepreneurial small firms. International Journal of Entrepreneurial Behaviour & Research, 12(6): 345-360.
18. Krogh, G.V. and J. Roos, 1996. Five Claims on Knowing. European Management Journal, 14(4): 423-426.
19. Koskinen, K.U. and H. Vanharanta, 2002. The Role Of Tacit Knowledge In Innovation Process Of Small Technology Companies. International Journal of Production Economics, 80: 57-64.
20. Gann, D., 2001. Putting Academic Ideas into Practice: Technological Progress and the Absorptive Capacity of Construction Organizations. Construction Management and Economics, 19: 321-330.
21. Vinding, A.L., 2006. Absorptive capacity and innovative performance: A human capital approach. Economics of Innovation and New Technology, 15(4): 507-517.
22. Lenox, M. and A. King, 2004. Prospects for Developing Absorptive Capacity Through Internal Information Provision. Strategic Management Journal, 25: 331-345.
23. Kim, L., 1993. National System of Industrial Innovation: Dynamics of Capability Building in Korea, in National Innovation Systems - A Comparative Analysis, R.R. Nelson, Editor 1993, Oxford University Press: New York.
24. Hou, C.M. and S. Gee, 1993. National Systems Supporting Technical Advance in Industry, in *National Innovation Systems - A Comparative Analysis*, R.R. Nelson, Editor Oxford University Press: New York.
25. Liao, J., H. Welsch and M. Stoica, 2003. Organizational Absorptive Capacity and Responsiveness: An Empirical Investigation of Growth-Oriented SMEs. Entrepreneurship Theory and Practice, Fall: pp: 63-86.
26. Kodama, T., 2008. The role of intermediation and absorptive capacity in facilitating university-industry linkages-An empirical study of TAMA in Japan. Research Policy, 37: 1224-1240.
27. Jong, J.P.J.D. and M. Freel, 2010. Absorptive capacity and the reach of collaboration in high technology small firms. Research Policy, 39: 47-54.
28. Muscio, A., 2007. The Impact of Absorptive Capacity on SMEs' Collaboration. Economics of Innovation and New Technology, 16(8): 653-668.
29. Barret, P., M. Sexton and A. Lee, 2008. Innovation in Small Construction Firms 2008, London: Taylor & Francis.
30. Walker, D.H.T., T. Maqsood and A. Finegan, 2005. The Culture of the Knowledge Advantage (K-Adv): A Holistic Strategic Approach to the Management of Knowledge, in Knowledge Management in the Construction Industry : A Socio-Technical Perspective, A.S. Kazi, Editor Idea Group Publishing: London.
31. Spithoven, A., B. Clarysse and M. Knockaert, 2011. Building Absorptive Capacity to Organise Inbound Open Innovation in Traditional Industries. Technovation, 31(1): 10-21.