The Journal of Management Theory and Practice (JMTP)
ISSN: 2716-7089, Volume-2, Issue-1,
http://dx.doi.org/10.37231/jmtp.2021.2.1.85
https://journal.unisza.edu.my/jmtp

A Conceptual Framework for the Effect of Project Complexity on Success of Railway Construction Projects: The Moderating Role of Effective Communications to All Stakeholders

[1]*Hassan Ghaleb, [2]Abdul Aziz Bin Abdullah

[1&2]Faculty of Business and Management, Universiti Sultan Zainal Abidin, 21300 Kuala Nerus, Terengganu. Malaysia

***Corresponding Author Email: hassan.alolofi@gmail.com**

Received: 17th January 2021 ***Accepted: 14th February 2021*** ***Published: 17th March 2021***

Abstract
The aim of this study is proposing a framework for the roll of effective communications to all stakeholders in moderating project complexity to improve project success. This paper deeply reviewed the studies published in project complexity and it is effect on success of construction project. This research reveals that effect communications as the most important factor can play a significant role in influencing the relationship between complexity and project success. It was confirmed from previous studies that the negative impact of project complexity on success of construction project is conclusive. Complexity dimensions identified by the Project Management Institute (PMI) into three groups are: human behaviour, ambiguity, and system behaviour. Many empirical studies proved there is a positive and significant relationship between project complexity and project success. Thus, there is a need for a moderating variable to enhance the success of complex construction projects. In this study the main contribution is bridging this gap of knowledge by empirical examining the relations between complexity of construction projects and project success with the interaction of effective communications to all stakeholders as a moderator. This study will enhance development of construction projects in Malaysia and assist scholars and practitioners to achieve maximum project success.

Keywords*:* Railway Construction Projects; Project complexity; Effective communications to all stakeholders; Project success.

OPEN ACCESS

INTRODUCTION

In recent years, project complexity has been one of the most important area of current project management research. Project complexity has become an important factor in project classification. However, within classification method, project complexity treated as a black box, and factors influencing complexity of project require further understanding (Lan, Qing-Hua, & Long-Long, 2015; Maylor, Richard, & Stephen, 2008). The main challenge facing CEOs is the complexity in growing volatile and uncertain globe. More than half of CEOs, however, voiced doubts about the capacity of their organization to handle it, and when asked to look down the path for five years, four out of five CEOs anticipated the complexity level to rise (PMI, 2013b).

Complexity is used in the literature to explain one of the reasons of cost overruns, schedule delays, and poor project performance. Researchers have concentrated on project complexity because understanding this subject is crucial for successful management (Kermanshachi & Safapour, 2019). The more projects become complex the more focus on project complexity concept and its impact on project management process. It is widely known in literature that project complexity is one of the important causes of project failure. Complexity makes completing projects very difficult and extra efforts are needed to succeed. Thus, systematic approach and efficient stakeholders management are demanded to achieve best outcomes of project performance (T.S & Sherif, 2018).
Construction projects well fit the complexity definition from the aspect of many different parts are being interrelated (Lan et al., 2015). Construction projects are historically suffering of poor performance and failure in terms of time delay, cost overruns, low quality and even safety issues because of project complexity. Early identifying and measuring complexity of construction project will drive to better understanding and great success in reducing associated risks (Kermanshachi & Safapour, 2019; Wood & Gidado, 2008). It is a common practice that projects fail in terms of cost overrun and schedule delays due to increasing complexity or underestimation of project complexity (M. Bosch-Rekveldt, Jongkind, Mooi, Bakker, & Verbraeck, 2011).

Transportation projects are progressively complex and in transportation projects many factors are contributing to complexity, thus it is not easy task to manage this complexity. It becomes a challenge and more difficult to execute complex transportation projects. Therefore, it is imperative to systematically evaluate complexity in transportation projects. A total of 258 transportation projects have been analysed and found 90% are over budget and for the rail projects the

average cost overrun is 45% (Chapman, 2016; A. T. Nguyen, Nguyen, Le-Hoai, & Dang, 2015).

An investigation on the influence of complexity on project success shows a strong relation between project success and project complexity. Generally, complexity is an equivalent measure of project difficulty and project success should be measured relatively with project complexity. Project success consists of three definitions. Firstly, project efficiency that is based on the triple constraints or iron triangle. Secondly, project effectiveness that comprises of product, client and organizational dimensions. Thirdly, project complexity success which contains project management success and project success (Mikkelsen, 2018). The traditional success criteria "Barnes' Iron Triangle" was one of the first endeavours to assess project success based on cost, time and performance. Over time, those criteria are expanded taking stakeholder satisfaction into account. Researches reveal that no single pattern has been developed to evaluate project success in different areas of application (Albert, Balve, & Spang, 2017). Project complexity concept is necessary well understood to enhance project manager contingency and increase project success (Kermanshachi & Safapour, 2019).
Complex projects in construction industry are increasing rapidly over the time. However, grasping project complexity is a crucial success factor in construction project management. Literatures have proven that project success is extremely influenced by complexity level in construction projects and classic project management approach is not adequate to handle that complexity. Reducing associated risk in complex projects is important for successful project management (Luo, He, Jaselskis, & Xie, 2017b). As reported by Project Management Institute (PMI) that organization ability to continue and succeed is significantly affected by ability to meet project cost, schedule and goals. Organizations facing complex and high-risk environment should address the imperative needs to improve the rate of project success (PMI, 2013c).

Effective stakeholder management is a vital success element for complex construction projects. Complex projects require systematic and effective management skills to achieve project success (T. S. Nguyen & Mohamed, 2018). In project management, communication is a critical competence when effectively implemented and all project team members are linked to the general elements of goals, actions, and strategies. If those elements are not properly shared by project managers and understood by stakeholders, project deliverables are in danger and budget incur risk. PMI reports uncovered that effective communications to all stakeholders is the most important success factor in project management (PMI, 2013c). Effective communication is an important factor which given insufficient attention in stakeholders communication. Tactics of effective communication can prevent project schedule delay and over budget. Recognizing techniques and skills for effective communications is necessary for project success. Project managers, engineers and designers often put communications low priority on their list. This placement is warranted as long as no major issues or problems. But when anything goes wrong, proactive, consistent, exception and effective communications with stakeholders will play a critical role in putting the project back on the right track quickly and finishing within budget and on time (Leonard S, 2016).

Railway projects is very important for economic and moving passengers and goods. Alike to other infrastructure projects, railway construction projects are large-scale, long implementation period, very complex in nature, complicated site conditions, and huge investment, also include many stakeholders. Therefore, such type of projects are associated with high risk which impacts project goals in terms of schedule delays, cost overruns, safety issues, and not meeting standard quality (Andrić, Wang, & Zhong, 2019). Railway projects are mega projects that are very complex and unique in nature. Railways construction projects are associated with big cost risk and this risk needed to be understood in details for effectively project management. It was confirmed that railway is the highest infrastructure projects with cost overruns of around 45%. Poor communication between project teams is one of the risk factors that lead to cost overrun in construction projects specially the railway projects (Fariq, Ismail, & Ab Rani, 2020). Malaysian railways is challenging to develop reliability and speed and become a road alternative. However, railway transportation is one of the best country transport mode. Railway transportation in Malaysia is consist of the heavy rail (commuter rail), light rapid transit (LRT), monorail, airport rail link and funicular railway line (Abd Aziz, Kassim, & Mohd Masirin, 2018).

The main objective of this study is to investigate the role of the effective communications to all stakeholders as a moderating factor on the relationship between project complexity and success of the railway projects in Malaysia. Furthermore, this study has the following sub-objectives:

- Investigating the influence of human behaviour on project success of railway projects.
- Investigating the influence of ambiguity on project success of railway projects.
- Investigating the influence of system behaviour on project success of railway projects.
- Investigating the moderating effect of effective communications to all stakeholders on the relationship between project complexity and success of railway projects.

Literature review

Project complexity

In current developing environment, it is well known that complexity of construction activates is increasing because of intense interrelation between the different parts in uncertain and changing patterns (Luo, He, Xie, Yang, & Wu, 2017). Many studies of project complexity identifies factors that influencing the entire project life cycle. However, there is still no general agreement among practitioners and academics about factors driving the project complexity (M. G. C. Bosch-Rekveldt, 2011). Gidado (1996) classified complexity factors into two groups. The first group including factors pertaining to inherent complexity (e.g., task difficulty, analysability, and technical complexity) and uncertainty factors. The second group consists of factors pertaining to interdependencies between different types of technologies, overlap of construction elements, and rigidity of sequence. Based on the previous grouping of complexity factors, Williams (1999) placed the numerous elements and interdependency under the structural complexity, attaching an extra component of

uncertainty in means and goals. Further study to explore complexity factors was conducted by Remington & Pollack (2007), who categorized influencing factors into four categories: structural complexity, technical complexity, directional complexity, and temporal complexity. Maylor et al. (2008) determined complexity factors in five categories. The first category is mission, the second is organization, the third is delivery, the fourth is stakeholders and the fifth one is team. Vidal and Marle (2008) identified the essential complexity drivers as project context-dependence, project interdependence, project variety, and project size. Wood and Ashton (2010) grouped the primary factors influencing project complexity in six categories: uncertainty, organizational complexity, inherent complexity, element interaction, number of trades, and rigidity of sequence. Lebcir and Choudrie (2011) attempt to develop a complexity model and identified four drivers of complexity in construction projects: uncertainty, interconnectivity, project newness, and project size. Xia and Chan (2012) determined main complexity measures in building projects as the following: building methods, project structure and function, urgency of the project schedule, geological condition, project scale/size, and neighbouring environment. Shane et al. (2015) expanded the traditional three-dimensional project management model (cost, schedule, and technical) and added two more factors: finance and context. These two extra factors are considering the influence of external risks. He et al. (2015) developed a six dimensions model of project complexity. The model includes information complexity, cultural, organizational, technological, goal, and environmental complexity.

Findings from literature review show that most scholars confirmed the interdependency between projects elements and their impact on project complexity (Gidado, 1996a; Tatikonda & Rosenthal, 2000). In addition, interfering between project components, dynamic behaviour of project components, and goals complexity are the most important drivers influencing project complexity (Gidado, 1996a; Stephen & Maylor, 2009; Williams, 1999). Thus, project complexity as an inherent characteristic to construction projects, which is resulting of the interactions between number of different elements with structural, uncertain and dynamic patterns. While most literature has shown different perspective and classification of project complexity, still there is a common agreement on confirmed factors particularly organizational and technological complexity (Baccarini, 1996; M. G. C. Bosch-Rekveldt, 2011).

As a practice guide, Project Management Institute (PMI), (2014) has classified the causes of complexity in projects into three comprehensive categories: human behaviour, system behaviour, and ambiguity. This three components model are describing the most factors causing project complexity.
Complexity theory (CT) defines the complex system within a specific field of interest and studies the interactions through the different elements of that system (Chu, Strand, & Fjelland, 2003). The complex system is defined as a system consists of many interdependent elements that interact continuously and spontaneously into a complex structure overtime (Lucas, 2000; Valle Jr, 2000). Managing a complex system is still difficult and challenging as prediction is not reliable and sense-making is also needed to occur (Sargut & McGrath, 2011). The challenge is shifting from the traditional control and command approach to accepting and adopting ambiguity. In the literature of project management, numerous views of project complexity have been presented as: types, key aspects, characteristics, dimensions, or complexity factors. However, in this study, the PMI dimensions of project complexity is chosen in the theoretical framework because it is developed from comprehensive literature review and because it is a practice guide that introduced by leading experts to integrate with PMI's basic standard. Therefore, research hypotheses are developed as the following:

Hypothesis 1- Project complexity has a negative influence on the success of railway construction projects.

1. H1.1- Human behaviour has a negative influence on success of railway construction projects.
2. H1.2- Ambiguity has a negative influence on success of railway construction projects.
3. H1.3- System behaviour has a negative influence on success of railway construction projects.

Project success

In construction industry, project success definition is still ambiguous and no common set of criteria to evaluate success (Chan, Scott, & Chan, 2004; Joslin & Müller, 2015a). Different stakeholders performing the same project have different project success evaluation standards (Joslin & Müller, 2015b; Lim & Mohamed, 1999). Concepts of project success and project performance are similar but project success is more significant (Chan et al., 2004). Project performance emphasizes on measures during project execution with project influence after implementation is also included. However, project success has a wider time range (Lim & Mohamed, 1999). The traditional project success criterion is named the *golden triangle*, which comprises of cost, time, and quality (Atkinson, 1999; Jugdev & Müller, 2005; Molenaar, Javernick-Will, Bastias, Wardwell, & Saller, 2013). These indicators are very important but insufficient to assess the new elements of project success (Atkinson, 1999; Ika, 2009). Moreover, project manager responsibilities and roles expand over the typical golden triangle covering other aspects such as cultural, relationships ,also managing stakeholder (Lam, Chiang, & Chan, 2011; Meng, Zhao, & Shen, 2011; Ozorhon & Cinar, 2015; Wong & Cheung, 2005). Bosch-Rekveldt (2011) suggested that evaluation of project success have to include different aspects. Not only completing the project within the estimated cost and schedule, success measures have to include end user satisfaction and the available deliverables. Lim and Mohamed (1999) investigated success measures of construction projects from different perspectives. The macro-perspective essentially focus on the relation between project planning and end-user satisfaction, while micro-perspective essentially focus on traditional success criteria: cost, time, and quality. Bryde and Robinson (2005) explained that project stakeholders (owners and contractors) are rating project success differently. Owners consider satisfaction of stakeholders, while contractors just use the classical constraints: schedule, budget, and quality. Chan et al. (2004) reviewed literature and developed a success standard model for construction projects. This model including cost, time, quality, environmental performance, health and safety, user satisfaction, participants' satisfaction and profit-oriented value. Lin et al. (2005) identified project success factors based on entire project lifecycle into three groups: preliminary, construction, and operation success. Yu et al. (2006) classified critical success factors for construction projects into five categories: human-related factors, project-related factors, input-related factors, output-related factors, and process-

related factors. Al-Tmeemy and Harun (2011) analysed building projects and grouped success criteria in three categories are product success, project management success, and market success. McLeod et al. (2012) developed a three dimensional framework of success criteria to evaluate the project success. This framework placed all stranded success measures in three categories are: process success, product success and organizational success.

According to the literature, project success is very wide and not just including project process but also contains the results after project completed. Various project stakeholders and participants are part of the project and strongly related to project success. According to the previous literature review, the approach of McLeod et al. (2012) is chosen in this study for selecting project success measures because this framework evaluates project success considering the influence of various stakeholder perspectives. They classified project success criteria into three primary categories: process success, product success, and organizational success.

Relationship between project complexity and project success:

Numerous studies stated that project success is dependent on the project complexity and conventional project management approach is not enough to address the complexity. Better understanding of project complex is required for effective project management (Luo, He, Jaselskis, & Xie, 2017a). Researches have proved that negative relationship is exist between project complexity and project success in construction projects (Luo, He, Xie, et al., 2017). Complexity of construction projects are increasing because of various factors and absence of complexity management is one of the main causes of project failure (Brady & Davies, 2014; Miller & Hobbs, 2005; Mirza & Ehsan, 2017; Shenhar & Holzmann, 2017). Scholars and practitioners focus on project complexity to improve the chance of successful project delivery (Bakhshi, Ireland, & Gorod, 2016; Luo, He, Jaselskis, et al., 2017b). In project management, all stakeholders are pursuing success as their ultimate goal (Chan et al., 2004; Chan, Scott, & Lam, 2002).Mega construction project is associated with high degree of complexity, which cause many difficulties and restrain successful project delivery (Kardes et al., 2013; Zeng et al., 2018). In mega construction projects, project managers and owners are suffering from low success rate because of ambiguity and of project complexity. In another words, complexity is the main problem that results in project failure in construction projects (Bakhshi et al., 2016; Ma & Fu, 2020). Complexity level is high in infrastructure projects due to their large scale and the degree of uncertainty and risk in process of project development. Associated problems such as unreliable scope, limited budget, and delivery methods with other external problems like technology, economics and environmental issues all together results to increasing complexity of infrastructure projects (Chen et al., 2004; Gidado, 1996b; Naderpajouh & Hastak, 2014). Studies on large scale projects pointed out that project complexity become more common regardless of their performance issues. Thus, cost overrun and schedule delay in complex infrastructure projects are usual than exceptional (Eriksson et al., 2017; Flyvbjerg, 2014; Locatelli et al., 2017).

Role of effective communications to all stakeholders on success of complex projects:

Construction industry is based on projects with various and fragmented companies constructing the temporary organisation (Alashwal et al., 2011; Vrijhoef & Koskela, 2005; Ye et al., 2015). In construction projects, coordination requires huge information exchange among stakeholders and project team. Thus, communication is essential for successful project delivery (Cheung et al., 2013; Laufer et al., 2008; Senescu et al., 2013; Yong & Mustaffa, 2013). Poor communications between project stakeholders is a main reason of project cost overruns, redoing work, and disputes (Ceric, 2014; Doloi et al., 2012; Hamzah et al., 2012; Mahamid, 2016; Memon et al., 2011; Sambasivan & Soon, 2007; Simpeh et al., 2015). Naoum & Egbu (2015) and Srdić & Šelih (2015) emphasise that inadequate information exchange is one of the causes for poor project performance.

Previous researches showed that communications is a critical element contributes into project success. Communication theories such as communication accommodation theory and diffusion theory are used to improve communication management (Anantatmula, 2015; Gallois & Giles, 2015). According to (PMI, 2008), Project communication management includes all activities involves information creation, collection, sharing, storage and ultimately arrangement of project information. Park et al., (2017) classified critical success factor for effective communication into three categories: two-way communication, active stakeholder participation, or minimization of dissatisfaction. Management of effective communications promote collaborative culture to develop a coherent project team. In addition, effective communication encourages participation in making decision to set up a learning platform for project team (Livesey, 2016). This is in line with the claim of Dainty et al., (2007) that communication can be a learning approach for both organization and individuals to build trust and create collaborative work environment. Senge (2006) stated that team learning process can be aligned with effective communication to achieve high-performance in team-based environment. In addition, effective communication is critical to control schedule and budget. Effective communication through the project team enhances knowledge and support team connection (Liu & Cross, 2016). PMI (2013) reported that 50% of complex project failure is attributed to the lack of effective communications between stakeholders. Consequently, the above theories and literature shows significant moderating effect of effective communications to all stakeholders on the relationship between complexity and project success. The following hypothesis is proposed as:

Hypothesis 2: effective communications to all stakeholders moderates the relationship between complexity and success in railway construction projects.

Proposed model:

The conceptual framework is developed based on underpinning theories and concepts to fill theoretical gap in literature. This study will examine the effect of effective communications to all stakeholders on project complex to improve success of construction projects. With considering previous literature, this is the first study intended to develop such unique research pattern as shown in Figure 1.

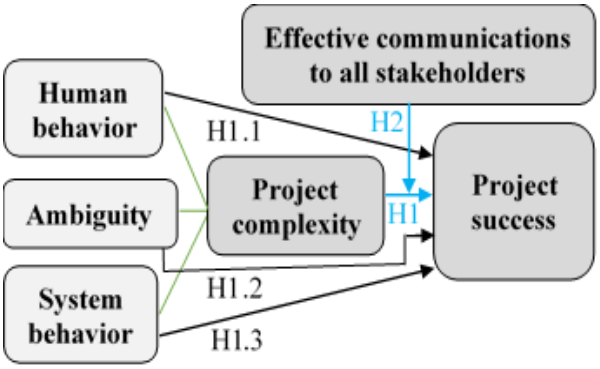

Figure1. The conceptual framework showing the integration of effective communications into project complexity to improve success of construction projects

METHODOLOGY

The conceptual framework of this study is developed in a process of four steps. The first step is identifying the different variables affecting success of construction projects in the literature. Then followed by identifying some gaps among project complexity, project success and effective communications to all stakeholders. The second step is conducting a comprehensive literature review with research focusing on complexity, effective communications and project success. The third step is comparing the results from previous studies and connect the relationship between the three variables, which leads to consistency in these results. The fourth step is developing and suggesting the conceptual framework, which is constructed based on identified variables. Thus, in this conceptual paper, the cause and effect relationship between dependent and independent variables need to be examined empirically to validate the theoretical framework.

CONCLUSION

The current study proposed a unique conceptual framework, which is different in contribution from all previous studies. Specifically, the major contribution in this study is introducing the effective communications between stakeholders as a moderating variable into the relationship between complexity and project success. Previous literature suggested that effective communications in complex construction projects will increase the success rate. In another words, that poor communications in complex construction project is the main reason cause project failure.

This study is contributing to the theory as it is introducing a different moderating variable into the complexity model. Furthermore, this study is significant to the literature because it is unique in Malaysian context (especially the railway construction projects). Effective communication to all stakeholders enhances project success in complex projects (T. S. Nguyen & Mohamed, 2018b). Many researches evaluated cost overruns phenomenon in transportation projects throughout project life-cycle (Cavalieri, Cristaudo, & Guccio, 2019b). However, none of these researches has included Malaysia railway projects. In spite of the fact that Malaysia is increasingly using railway projects to convey services and goods to its people.

The current proposed conceptual framework can provide practitioners and academicians with better insight into the application of successful project delivery. This study will assist researchers, practitioners, and interested individuals to identify the important factors for effective communications, complexity or project success. In addition, the future work of this research is to conduct an empirical study in construction transportation industry to fulfil the knowledge gap in the project management literature.

REFERENCES

Al-Tmeemy, S. M. H. M., Abdul-Rahman, H., & Harun, Z. (2011). Future criteria for success of building projects in Malaysia. International Journal of Project Management, 29(3), 337–348. https://doi.org/10.1016/j.ijproman.2010.03.003

Alashwal, A. M., Rahman, H. A., & Beksin, A. M. (2011). Knowledge sharing in a fragmented construction industry: On the hindsight. Scientific Research and Essays, 6(7), 1530–1536. https://doi.org/10.5897/SRE10.645

Albert, M., Balve, P., & Spang, K. (2017). Evaluation of project success : a structured literature review. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/IJMPB-01-2017-0004/full/html

Anantatmula, V. S. (2015). Strategies for enhancing project performance. Journal of Management in Engineering, 31(6), 4015013. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000369

Andrić, J. M., Wang, J., & Zhong, R. (2019). Identifying the critical risks in railway projects based on fuzzy and sensitivity analysis: A case study of belt and road projects. Sustainability, 11(5), 1302. https://doi.org/10.3390/su11051302

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. International Journal of Project Management, 17(6), 337–342. https://doi.org/10.1016/S0263-7863(98)00069-6

Baccarini, D. (1996). The concept of project complexity—a review. International Journal of Project Management, 14(4), 201–204. https://doi.org/10.1016/0263-7863(95)00093-3

Bakhshi, J., Ireland, V., & Gorod, A. (2016). Clarifying the project complexity construct: Past, present and future. International Journal of Project Management, 34(7), 1199–1213. https://doi.org/10.1016/j.ijproman.2016.06.002

Bosch-Rekveldt, M. G. C. (2011). Managing project complexity: A study into adapting early project phases to improve project performance in large engineering projects. Delft Centre for Project Management, Delft, Netherlands. http://resolver.tudelft.nl/uuid:a783e581-bc7a-4efa-adcb-7e9201840367

Bosch-Rekveldt, M., Jongkind, Y., Mooi, H., Bakker, H., & Verbraeck, A. (2011). Grasping project complexity in large engineering projects: The TOE (Technical, Organizational and Environmental) framework. International Journal of Project Management, 29(6), 728–739. https://doi.org/10.1016/j.ijproman.2010.07.008

Brady, T., & Davies, A. (2014). Managing structural and dynamic complexity: A tale of two projects. Project Management Journal, 45(4), 21–38. https://doi.org/10.1002/pmj.21434

Bryde, D. J., & Robinson, L. (2005). Client versus contractor perspectives on project success criteria. International Journal of Project Management, 23(8), 622–629. https://doi.org/10.1016/j.ijproman.2005.05.003

Ceric, A. (2014). Minimizing communication risk in construction: a Delphi study of the key role of project managers. Journal of Civil Engineering and Management, 20(6), 829–838. https://doi.org/10.3846/13923730.2013.802739

Chan, A. P. C., Scott, D., & Chan, A. P. L. (2004). Factors affecting the success of a construction project. Journal of Construction Engineering and Management, 130(1), 153–155. https://doi.org/10.1061/(ASCE)0733-9364(2004)130:1(153)

Cavalieri, M., Cristaudo, R., & Guccio, C. (2019b). On the magnitude of cost overruns throughout the project life-cycle: An assessment for the Italian transport infrastructure projects. Transport Policy, 79(April 2018), 21–36. https://doi.org/10.1016/j.tranpol.2019.04.001

Chan, A. P. C., Scott, D., & Lam, E. W. M. (2002). Framework of success criteria for design/build projects. Journal of Management in Engineering, 18(3), 120–128. https://doi.org/10.1061/(ASCE)0742-597X(2002)18:3(120)

Chapman, R. J. (2016). A framework for examining the dimensions and characteristics of complexity inherent within rail megaprojects. International Journal of Project Management, 34(6), 937–956. https://doi.org/10.1016/j.ijproman.2016.05.001

Chen, H., Guilin, H., Poon, S. W., & Ng, F. F. (2004). Cost risk management in West Rail project of Hong Kong. AACE International Transactions, IN91. https://search.proquest.com/scholarly-journals/cost-risk-management-west-rail-project-hong-kong/docview/208179138/se-2?accountid=201395

Cheung, S. O., Yiu, T. W., & Lam, M. C. (2013). Interweaving trust and communication with project performance. Journal of Construction Engineering and Management, 139(8), 941–950. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000681

Chu, D., Strand, R., & Fjelland, R. (2003). Theories of complexity. Complexity, 8(3), 19–30. https://doi.org/10.1002/cplx.10059

Dainty, A., Moore, D., & Murray, M. (2007). Communication in construction: Theory and practice. Routledge. https://books.google.com.my/books?id=2n9_AgAAQBAJ&lpg=PP1&ots=iMfIGJ1zwX&dq=Communication%20in%20construction%3A%20Theory%20and%20practice.&lr&pg=PR5#v=onepage&q=Communication%20in%20construction:%20Theory%20and%20practice.&f=false

Doloi, H., Sawhney, A., Iyer, K. C., & Rentala, S. (2012). Analysing factors affecting delays in Indian construction projects. International Journal of Project Management, 30(4), 479–489. https://doi.org/10.1016/j.ijproman.2011.10.004

Eriksson, P. E., Larsson, J., & Pesämaa, O. (2017). Managing complex projects in the infrastructure sector—A structural equation model for flexibility-focused project management. International Journal of Project Management, 35(8), 1512–1523. https://doi.org/10.1016/j.ijproman.2017.08.015

Fariq, N., Ismail, S., & Ab Rani, N. I. (2020). Cost Risk of Railway Project and Its Effective Mitigation Strategies. Journal of Critical Reviews (ISSN: 2394-5125), 7(8), 1275–1280. http://dx.doi.org/10.31838/jcr.07.08.262

Flyvbjerg, B. (2014). What you should know about megaprojects and why: An overview. Project Management Journal, 45(2), 6–19. https://doi.org/10.1002/pmj.21409

Gallois, C., & Giles, H. (2015). Communication accommodation theory. The International Encyclopedia of Language and Social Interaction, 1–18. https://doi.org/10.1002/9781118611463.wbielsi066

Gidado, K. I. (1996a). Project complexity: The focal point of construction production planning. Construction Management & Economics, 14(3), 213–225. https://doi.org/10.1080/014461996373476

Gidado, K. I. (1996b). Project complexity: The focal point of construction production planning. Construction Management and Economics, 14(3), 213–225. https://doi.org/10.1080/014461996373476

Hamzah, N., Khoiry, M. A., Arshad, I., Badaruzzaman, W. H. W., & Tawil, N. M. (2012). Identification of the causes of construction delay in Malaysia. In Proceedings of world academy of science, engineering and technology (p. 614). World Academy of Science, Engineering and Technology (WASET), 72(12), 312-317. https://www.academia.edu/download/32026087/Identification_of_the_causes_of_construction_delay_in_Malaysia.pdf

He, Q., Luo, L., Hu, Y., & Chan, A. P. C. (2015). Measuring the complexity of mega construction projects in China—A fuzzy analytic network process analysis. International Journal of Project Management, 33(3), 549–563. https://doi.org/10.1016/j.ijproman.2014.07.009

Ika, L. A. (2009). Project success as a topic in project management journals. Project Management Journal, 40(4), 6–19. https://doi.org/10.1002/pmj.20137

Joslin, R., & Müller, R. (2015a). Relationships between a project management methodology and project success in different project governance contexts. International Journal of Project Management, 33(6), 1377–1392. https://doi.org/10.1016/j.ijproman.2015.03.005

Joslin, R., & Müller, R. (2015b). Relationships between a project management methodology and project success in different project governance contexts. International Journal of Project Management, 33(6), 1377–1392. https://doi.org/10.1016/j.ijproman.2015.03.005

Jugdev, K., & Müller, R. (2005). A retrospective look at our evolving understanding of project success. Project Management Journal, 36(4), 19–31. https://doi.org/10.1177/875697280503600403

Kardes, I., Ozturk, A., Cavusgil, S. T., & Cavusgil, E. (2013). Managing global megaprojects: Complexity and risk management. International Business Review, 22(6), 905–917. https://doi.org/10.1016/j.ibusrev.2013.01.003

Kermanshachi, S., & Safapour, E. (2019). Identification and Quantification of Project Complexity From Perspective of Primary Stakeholders in Us Construction Projects. Journal of Civil Engineering and Management, 25(4), 380–398. https://doi.org/10.3846/jcem.2019.8633

Lam, P. T. I., Chiang, Y. H., & Chan, S. H. (2011). Critical success factors for bond financing of construction projects in Asia. Journal of Management in Engineering, 27(4), 190–199. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000063

Lan, L., Qing-Hua, H., & Long-Long, S. (2015). Identifying the Project Complexity Factors of Complex Construction Projects. 2015 International Conference on Management Science & Engineering (22th), (71390523), 1697–1702. Retrieved from http://icmse.hit.edu.cn/icmsecn/ch/reader/create_pdf.aspx?file_no=L2015090226&flag=2

Laufer, A., Shapira, A., & Telem, D. (2008). Communicating in dynamic conditions: How do on-site construction project managers do it? Journal of Management in Engineering, 24(2), 75–86. https://doi.org/10.1061/(ASCE)0742-597X(2008)24:2(75)

Lebcir, R. M., & Choudrie, J. (2011). A dynamic model of the effects of project complexity on time to complete construction projects. International Journal of Innovation, Management and Technology, 2(6), 477. http://www.ijimt.org/papers/179-A10002.pdf

Leonard S, G. (2016). Effective Communications for Project Success. Wiley Online Library, 26(2), 101–108. https://doi.org/10.1002/rem

Lim, C. S., & Mohamed, M. Z. (1999). Criteria of project success: an exploratory re-examination. International Journal of Project Management, 17(4), 243–248. https://doi.org/10.1016/S0263-7863(98)00040-4

Lin, M., Shen, L., MA, S., & CHEN, J. (2005). New System of Project Success Criteria: Base on the Total Life Cycle of Project [J]. Industrial Engineering and Management, 1. https://en.cnki.com.cn/Article_en/CJFDTotal-GYGC200501028.htm

Liu, W.-H., & Cross, J. A. (2016). A comprehensive model of project team technical performance. International Journal of Project Management, 34(7), 1150–1166. https://doi.org/10.1016/j.ijproman.2016.05.011

Livesey, P. V. (2016). Insights of project managers into the problems in project management. Construction Economics and Building, 16(1), 90–103. https://doi.org/10.5130/AJCEB.v16i1.4600

Locatelli, G., Mikic, M., Kovacevic, M., Brookes, N., & Ivanisevic, N. (2017). The successful delivery of megaprojects: a novel research method. Project Management Journal, 48(5), 78–94. https://doi.org/10.1177/875697281704800506

Lucas, C. (2000). Quantifying complexity theory. CALResCo Group. URL: http://www. Calresco. Org/Lucas/Quantify. Htm.

Luo, L., He, Q., Jaselskis, E. J., & Xie, J. (2017a). Construction project complexity: research trends and implications. Journal of Construction Engineering and Management, 143(7), 4017019. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001306

Luo, L., He, Q., Jaselskis, E. J., & Xie, J. (2017b). Construction project complexity: Research trends and implications. Journal of Construction Engineering and Management, 143(7). https://doi.org/10.1061/(ASCE)CO.1943-7862.0001306

Luo, L., He, Q., Xie, J., Yang, D., & Wu, G. (2017). Investigating the relationship between project complexity and success in complex construction projects. Journal of Management in Engineering, 33(2), 4016036. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000471

Ma, L., & Fu, H. (2020). Exploring the influence of project complexity on the mega construction project success: a qualitative comparative analysis (QCA) method. Engineering, Construction and Architectural Management. https://doi.org/10.1108/ECAM-12-2019-0679

Mahamid, I. (2016). Micro and macro level of dispute causes in residential building projects: Studies of Saudi Arabia. Journal of King Saud University-Engineering Sciences, 28(1), 12–20. https://doi.org/10.1016/j.jksues.2014.03.002

Maylor, H., Richard, V., & Stephen, C. (2008). Managerial Complexity in Project- Based Operations: A Grounded Model and Its Implications for Practice. Project Management Journal, 39, 28–42. https://doi.org/10.1002/pmj

Maylor, H., Vidgen, R., & Carver, S. (2008). Managerial complexity in project-based operations: A grounded model and its implications for practice. Project Management Journal, 39(1_suppl), S15–S26. https://doi.org/10.1002/pmj.20057

McLeod, L., Doolin, B., & MacDonell, S. G. (2012). A perspective-based understanding of project success. Project Management Journal, 43(5), 68–86. https://doi.org/10.1002/pmj.21290

Memon, A. H., Abdul Rahman, I., & Aziz, A. A. A. (2011). Time overrun in construction projects from the perspective of project management consultant (PMC). Journal of Surveying, Construction and Property, 2(1). https://doi.org/10.22452/jscp.vol2no1.4

Meng, X., Zhao, Q., & Shen, Q. (2011). Critical success factors for transfer-operate-transfer urban water supply projects in China. Journal of Management in Engineering, 27(4), 243–251. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000058

Mikkelsen, M. F. (2018). Projects, success, and complexity. In International Project Management Association Research Conference 2017 (pp. 0–13). Project Management Research and Practice. https://doi.org/10.5130/pmrp.ipmarc2017.5618

Miller, R., & Hobbs, B. (2005). Governance regimes for large complex projects. Project Management Journal, 36(3), 42–50. https://doi.org/10.1177/875697280503600305

Mirza, E., & Ehsan, N. (2017). Quantification of project execution complexity and its effect on performance of infrastructure development projects. Engineering Management Journal, 29(2), 108–123. https://doi.org/10.1080/10429247.2017.1309632

Molenaar, K. R., Javernick-Will, A., Bastias, A. G., Wardwell, M. A., & Saller, K. (2013). Construction project peer reviews as an early indicator of project success. Journal of Management in Engineering, 29(4), 327–333. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000149

Naderpajouh, N., & Hastak, M. (2014). Quantitative analysis of policies for governance of emergent dynamics in complex construction projects. Construction Management and Economics, 32(12), 1222–1237. https://doi.org/10.1080/01446193.2014.980835

Naoum, S., & Egbu, C. (2015). Critical review of procurement method research in construction journals. Procedia Economics and Finance, 21, 6–13. https://doi.org/10.1016/S2212-5671(15)00144-6

Nguyen, A. T., Nguyen, L. D., Le-Hoai, L., & Dang, C. N. (2015). Quantifying the complexity of transportation projects using the fuzzy analytic hierarchy process. International Journal of Project Management, 33(6), 1364–1376. https://doi.org/10.1016/j.ijproman.2015.02.007

Nguyen, T. S., & Mohamed, S. (2018). Stakeholder Management in Complex Projects. The 7th World Construction Symposium 2018, (July). https://research-repository.griffith.edu.au/bitstream/handle/10072/385361/NGUYEN221601.pdf?sequence=1

Ozorhon, B., & Cinar, E. (2015). Critical success factors of enterprise resource planning implementation in construction: Case of Turkey. Journal of Management in Engineering, 31(6), 4015014. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000370

Park, H., Kim, K., Kim, Y.-W., & Kim, H. (2017). Stakeholder management in long-term complex megaconstruction projects: The Saemangeum Project. Journal of Management in Engineering, 33(4), 5017002. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000515

PMI. (2013a). PMI's Pulse of the Profession In-Depth Report: navigating complexity. PMI Publishing Division. https://www.pmi.org/~/media/PDF/Business-Solutions/Navigating_Complexity.ashx#:~:text=PMI's%20Pulse%20of%20the%20Profession%E2%84%A2%20In%2DDepth%20Report%3A%20Navigating,their%20complex%20projects%20and%20programs.&text=Recognizing%20it%20is%20one%20thing,organizational%20capability%20is%20quite%20another

PMI. (2013b). PMI's Pulse of the Profession In-Depth Report: Navigating Complexity. Project Management Institute, Inc.

PMI. (2013c). The high cost of low performacne_The Essential Role of Communications Report _ PMI Pulse of Profession-2013-PMI.pdf. Retrieved from https://www.pmi.org/-/media/pmi/documents/public/pdf/learning/thought-leadership/pulse/the-essential-role-of-communications.pdf

PMI. (2014). Navigating Complexity: A Practice Guide. Pennsylvania, USA. https://www.pmi.org/pmbok-guide-standards/practice-guides/complexity

PMI, A. (2008). Guide to the Project Management Body of Knowledge (PMBoK Guide 4th ed). PMI, USA.

Remington, K., & Pollack, J. (2007). Tools for Complex Projects. Gower Publishing company. Aldershott, UK. https://books.google.com.my/books?id=bNQ5QAbRuqsC&lpg=PR11&ots=6AgTzBup2Z&dq=Tools%20for%20Complex%20Projects&lr&pg=PR11#v=onepage&q=Tools%20for%20Complex%20Projects&f=false

Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. International Journal of Project Management, 25(5), 517–526. https://doi.org/10.1016/j.ijproman.2006.11.007

Sargut, G., & McGrath, R. G. (2011). Learning to live with complexity. Harvard Business Review, 89(9), 68–76. https://www.billsynnotandassociates.com.au/images/stories/documents/complexity.pdf

Senescu, R. R., Aranda-Mena, G., & Haymaker, J. R. (2013). Relationships between project complexity and communication. Journal of Management in Engineering, 29(2), 183–197. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000121

Senge, P. M. (2006). The fifth discipline: The art and practice of the learning organization (Rev. ed.). New York, NY: Currency Doubleday. http://www.semesteratsea.org/wp-content/uploads/2012/04/Bailey_ENGR2595_SYSThinking.pdf

Shane, J., Strong, K., Gransberg, D., & Jeong, D. (2015). Guide to project management strategies for complex projects, National Academies of Science, Washington, DC. http://www.trb.org/Main/Blurbs/167482.aspx

Shenhar, A., & Holzmann, V. (2017). The three secrets of megaproject success: Clear strategic vision, total alignment, and adapting to complexity. Project Management Journal, 48(6), 29–46. https://doi.org/10.1177/875697281704800604

Simpeh, E. K., Ndihokubwayo, R., Love, P. E. D., & Thwala, W. D. (2015). A rework probability model: a quantitative assessment of rework occurrence in construction projects. International Journal of Construction Management, 15(2), 109–116. https://doi.org/10.1080/15623599.2015.1033814

Srdić, A., & Šelih, J. (2015). Delays in construction projects: causes and mitigation. Organization, Technology & Management in Construction: An International Journal, 7(3), 1383–1389. https://doi.org/10.5592/otmcj.2015.3.5

Stephen, W. J., & Maylor, H. (2009). And then came Complex Project Management. International Journal of Project Management, 27(3), 304–310. https://eprints.usq.edu.au/6926/2/Whitty_Maylor_2007_PV.pdf

T.S, N., & Sherif, M. (2018). Stakeholder management in complex projects. In The 7th World Construction Symposium 2018: Built Asset Sustainability: Rethinking Design, Construction and Operations (pp. 497-506). https://research-repository.griffith.edu.au/bitstream/handle/10072/385361/NGUYEN221601.pdf?sequence=1

Tatikonda, M. V, & Rosenthal, S. R. (2000). Technology novelty, project complexity, and product development project execution success: a deeper look at task uncertainty in product innovation. IEEE Transactions on Engineering Management, 47(1), 74–87. https://doi.or/10.1109/17.820727

Valle Jr, V. (2000). Chaos, complexity and deterrence. NATIONAL DEFENSE UNIV WASHINGTON DC. https://apps.dtic.mil/sti/pdfs/ADA432927.pdf

Vidal, L., & Marle, F. (2008). Understanding project complexity: implications on project management. Kybernetes, 37(8), 1094–1110. Emerald Group Publishing Limited. https://doi.org/10.1108/03684920810884928

Vrijhoef, R., & Koskela, L. (2005). A critical review of construction as a project-based industry: identifying paths towards a project-independent approach to construction. Proceedings CIB Combining Forces. June, Helsinki. Forthcoming. 13-24. http://www.irbnet.de/daten/iconda/CIB6804.pdf

Williams, T. M. (1999). The need for new paradigms for complex projects. International Journal of Project Management, 17(5), 269–273. https://doi.org/10.1016/S0263-7863(98)00047-7

Wong, P. S. P., & Cheung, S. O. (2005). Structural equation model of trust and partnering success. Journal of Management in Engineering, 21(2), 70–80. https://doi.org/10.1061/(ASCE)0742-597X(2005)21:2(70)

Wood, H., & Ashton, P. (2010). The factors of project complexity. In TG62-Special Track 18th CIB World Building Congress, CIB Publication, Rotterdam, Netherlands. http://site.cibworld.nl/dl/publications/tg62_pub353.pdf#page=73

Wood, H., & Gidado, K. (2008). Project complexity in construction. COBRA 2008 - Construction and Building Research Conference of the Royal Institution of Chartered Surveyors, 1–13. https://www.researchgate.net/profile/Kassim_Gidado/publication/266281421_Project_Complexity_in_Construction/links/54ee05ed0cf2e2830863e003.pdf

Xia, B., & Chan, A. P. C. (2012). Measuring complexity for building projects: a Delphi study. Engineering, Construction and Architectural Management. https://doi.org/10.1108/09699981211192544

Ye, G., Jin, Z., Xia, B., & Skitmore, M. (2015). Analyzing causes for reworks in construction projects in China. Journal of Management in Engineering, 31(6), 4014097. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000347

Yong, Y. C., & Mustaffa, N. E. (2013). Critical success factors for Malaysian construction projects: an empirical assessment. Construction Management and Economics, 31(9), 959–978. https://doi.org/10.1080/01446193.2013.828843

Yu, A. T. W., Shen, Q., Kelly, J., & Hunter, K. (2006). Investigation of critical success factors in construction project briefing by way of content analysis. Journal of Construction Engineering and Management, 132(11), 1178–1186. https://doi.org/10.1061/(ASCE)0733-9364(2006)132:11(1178)

Zeng, W., Zhang, J., Wang, H., & Zhou, H. (2018). Supplier development and its incentives in infrastructure mega-projects: A case study on Hong Kong-zhuhai-macao bridge project. Frontiers of Engineering Management, 5(1), 88–97. https://doi.org/10.15302/J-FEM-2018077