



Systematic Review of Cost Overrun Research in the Developed and Developing Countries

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Abstract: For decades, reputation of the construction industry has been tainted by poor cost performance caused by project cost overrun. In addition, studies by scholars worldwide have also found cost overrun to be more serious in developing countries compared to the developed countries. Despite the numerous researches addressing the issue of cost overrun in the construction industry through the years, the issue remains. Acknowledging that maintaining good cost performance is a key factor of project success and that the issue has persisted for decades, this study aims to explore the distinction of cost overrun studies that has been conducted between developed nations and developing nations. In achieving this aim, a systematic literature review is performed by following the integrative steps of PSALSAR (Protocol, Search, Appraisal, Synthesis, Analysis and Report) and PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) for screening and selecting the retrieved studies. The synthesis and screening of literatures have yielded with 152 articles which are then classified into their countries, developed countries (44) and developing countries (108). The results indicated a significant difference in the domain of research on cost overrun between the 2 nations. Despite the numerous studies on cost overrun in the developing nations compared to developed nations, the majority of the studies are not directed to any specific type construction while developed nations have moved forward to focus on more specific projects. The project with the highest attention in the developed nations is transport infrastructure construction projects, particularly rail infrastructure projects. The findings of this study have shown that there have been broad studies conducted on cost overrun in both developing nations and developed nations. However, there is a slight lacking in comprehensiveness of cost overrun studies in the developing nations, perhaps future studies on cost overrun in developing nations can be directed to more specific areas of construction projects such as those that have been performed by researchers of the developed nations.

Keywords: Cost overrun, construction, infrastructure projects

1. Introduction

The growth of construction industry is vital in expanding the economy as it promotes the growth of other industries as well (Rum & Akasah, 2011). A government of developing countries worldwide has been using the construction industry as a medium to elevate the economy into the status of a developed country (Mat Isa et al. 2015).

Unfortunately, every so often the reputation of the industry gets flawed by improper project performances (Mpofu et al. 2017; Trigunaryah and Islam, 2017; Yap and Skitmore, 2018). Poor construction development directly influences the project accomplishment and also subsequently inhibits the advancement into achieving developed nation status (Khan et al. 2014).

To achieve a successful construction project, there are three main elements that must be satisfied, time, cost and quality (Olawale & Sun, 2010). Other than that, there have also been many scholars that discovered various success

factors beyond the three (Tabish & Jha, 2018; Toor & Ogunlana, 2010), however, it was found that maintaining good cost performance is the key factor of project success (Masrom et al., 2015).

Notwithstanding the fact, maintaining good cost performance has been proven to be complicated as cost overrun often occurs in projects and it is not a new issue across the construction industries worldwide (Flyvbjerg et al., 2003; Cantarelli et al., 2012; Odeck et al., 2015). The issues that have persisted for decades have brought about numerous studies by scholars worldwide (Shah, 2016) especially in the developed and developing nations (Asiedu & Adaku, 2019).

This study aims to explore the distinction of cost overrun studies that has been conducted between developed nations and developing nations by conducting systematic literature review on cost overrun studies worldwide between 2010-2020.

2. Literature Review

2.1 Cost Overrun Problem in the Construction Industry

As the major factor in project success is completion on budget (Flyvbjerg et al., 2003), the measurement of cost performance becomes the key indication of an organization's success in profitability and productivity (Masrom et al., 2015; Olawale & Sun, 2010). However, poor cost performance persists to be a significant problem stemming in massive cost overrun as experienced by the global construction industry (Memon & Rahman, 2014).

As stated by Azhar et al. (2008), cost overrun occurs regularly and is almost connected with all projects in the construction industry. An exhaustive research that covered 20 nations and 5 continents by Flyvbjerg et al. (2003) found that 9 out of 10 projects had cost overrun of between 50 to 100 percent. The study also found that cost overrun has been occurring constantly for the last 70 years for which data were available.

Being a frequent subject of discussion in literatures, all of which sustained that it is a significant setback in construction projects (Shehu et al., 2014), cost overrun is discovered to be a severe issue globally (Azhar et al., 2008). It is crucial to address the root causes of this issue in order to find the right contingencies, if not solutions (Durdyev et al., 2017).

2.2 Contemporary Research on Cost Overrun

Few scholars have studied the problem of cost overruns in construction projects worldwide. Some of them have dedicated their research to prove the significance of the issue (Flyvbjerg et al., 2003; Odeck, 2004; Love et al., 2015; 2016). There are also few studies on the quantitative assessment of cost overruns in construction projects, among the studies are conducted by Ahbab (2012), Prajapati et al. (2016), Bentil et al. (2017) and Memon et al. (2012). Most of these researches emphasized on either the factors causing cost overruns or its influences on construction projects (Andrić et al., 2019) and often produce proposals for controlling the phenomenon (Asmi et al., 2013).

Throughout the decades, researches have improved their scope from studying cost overruns in general construction projects to a more specified projects such as buildings (Shrestha et al., 2019), infrastructures (Love et al., 2017), industrial (Robu et al., 2018) and many others. To date, there is still no clear sign of improvement on the problem of cost overrun or enhancement on the reliability of project cost management (Siemietycki, 2018). At present, construction industry may have earned the reputation of delivering projects over budget, again and again, leaving clients dissatisfied and the tax-payer often out of pocket (Marinelli et al., 2017).

2.3 Cost Overrun Studies in Developed Nations

The World Bank has established categories of each country in the world based on Gross National Income (GNI) per capita per year. Countries with GNI of or less than US\$ 12,375 are categorized as developing countries while those with GNI of or more than US\$ 12,375 are developed countries (World Bank, 2019).

Nevertheless, huge cost overrun causing of poor cost performance remains a well-known occurrence in both the developed and developing nations (Memon & Rahman, 2014). Studies on cost overrun has been initiated since the 80's on both the developed and developing nations (Arditi et al., 1985; Avotos, 1983). Specifically in developed nations, Meng (2012) studied on 103 construction projects in UK and uncovered that 25.2% of the projects encountered cost overrun.

In USA, Chang (2002) conducted case study on four projects and found that all the projects experienced cost overrun ranging from 12.3% to 51.3% with an average of 24.8% of the contract sum. In Slovenia, Žujo et al. (2010) studied 92 traffic structures and established that the cost went beyond the budgeted cost by 51%.

2.4 Cost Overrun Studies in Developing Nations

Derakhshanlavijeh & Teixeira (2017) defined developing nations as countries that have not attained a significant level of industrialization comparative to their population. It is well-acknowledged that cost overrun is a common phenomenon in projects worldwide. However, the issue is particularly critical in developing countries (Le-Hoai et al., 2008) due to economic hurdles that often cause financial tightness to the construction projects (Asiedu & Adaku, 2019).

Developing countries also have various issues spanning from political instability to unavailability of human resources and the rate and effect of inflation (Patrick et al., 2015). The issue of poor cost performance in developing countries have been proven by Vaardini et al. (2016), Yap et al. (2019), Gurara et al. (2017) and many other scholars whom have highlighted the significance of cost overrun issues in construction projects among developing countries.

3. Research Methodology

This study uses systematic review to accomplish the research objectives. As stated by Newaz et al. (2018), systematic review helps to draw a transparent conclusion while minimizing bias. The systematic literature review in this study follows the steps of PSALSAR (Protocol, Search, Appraisal, Synthesis, Analysis and Report).

The method was pioneered by Booth et al. (2016) with the initial acronym SALSA (Search, Appraisal, Synthesis, Analysis). It was then applied by few scholars such as Shamsulhadi & Fadhlin (2016), Zafira et al. (2018) and Ismail et al. (2018). In the latest study, Mengist et al. (2020) supplemented another two actions which are protocol and reporting result.

After establishing the review protocol, the author starts searching for articles in databases which include Scopus, Science Direct and Web of Science. Then, additional relevant articles were acquired by forward and backward reference searching technique (Okoli and Schabram 2010). The keyword string used in searching is “Cost Overrun” and “Construction” as it reflects the objective of the literature review.

Subsequently, appraisal was conducted for the retrieved articles. In checking and selecting the retrieved articles, this study employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist by accounting from the pre-defined inclusion and exclusion criteria (Tarhini et al. 2015; Dikert et al. 2016).

This study reviews articles with diverse research methodology including quantitative, qualitative, and mixed-methods articles providing that the articles suit the criteria of 1) peer-reviewed articles or conference papers, 2) research focused on cost overrun in the construction industry, and 3) studies focused on a certain type of projects or countries. Other than that, the following exclusion criteria were applied 1) identical articles which have been taken from other resources and 2) articles without specification on the location in the scope of study.

The acronym was then changed from SALSA to PSALSAR. It is an explicit, transferable and reproducible procedure to conduct systematic review work. Details of the processes carried out for the study are further explained in Table 1.

Table 1 - The PSALSAR framework

Steps	Outcomes	Methods
Protocol	Define study scope	Worldwide cost overrun studies between 2010-2020
Search	Define search strategy	<ul style="list-style-type: none"> • Use databases (Scopus, Science Direct, Web of Science) • Searching strings (“cost overrun” and “construction”) • Snowball technique of forward and backward searching
Appraisal	Selecting studies	<ul style="list-style-type: none"> • Using PRISMA checklist • Defining inclusion criteria (discusses cost overrun issues) • Defining exclusion criteria (not related to construction)
Steps	Outcomes	Methods
Synthesis	Extract data (using NVIVO software)	<ul style="list-style-type: none"> • Sorting the list to establish connections • Categorizing the data according to the areas of construction and countries related
Analysis	<ul style="list-style-type: none"> • Data analysis • Result and discussion • Conclusion 	<ul style="list-style-type: none"> • Quantitative categories, description, and narrative analysis of the organized data • Identifying the trends, gap and comparing result • Deriving conclusion and recommendation
Report	<ul style="list-style-type: none"> • Report writing • Article production 	<ul style="list-style-type: none"> • Arranging the writing to a specific template • Summarizing the report result for the larger public

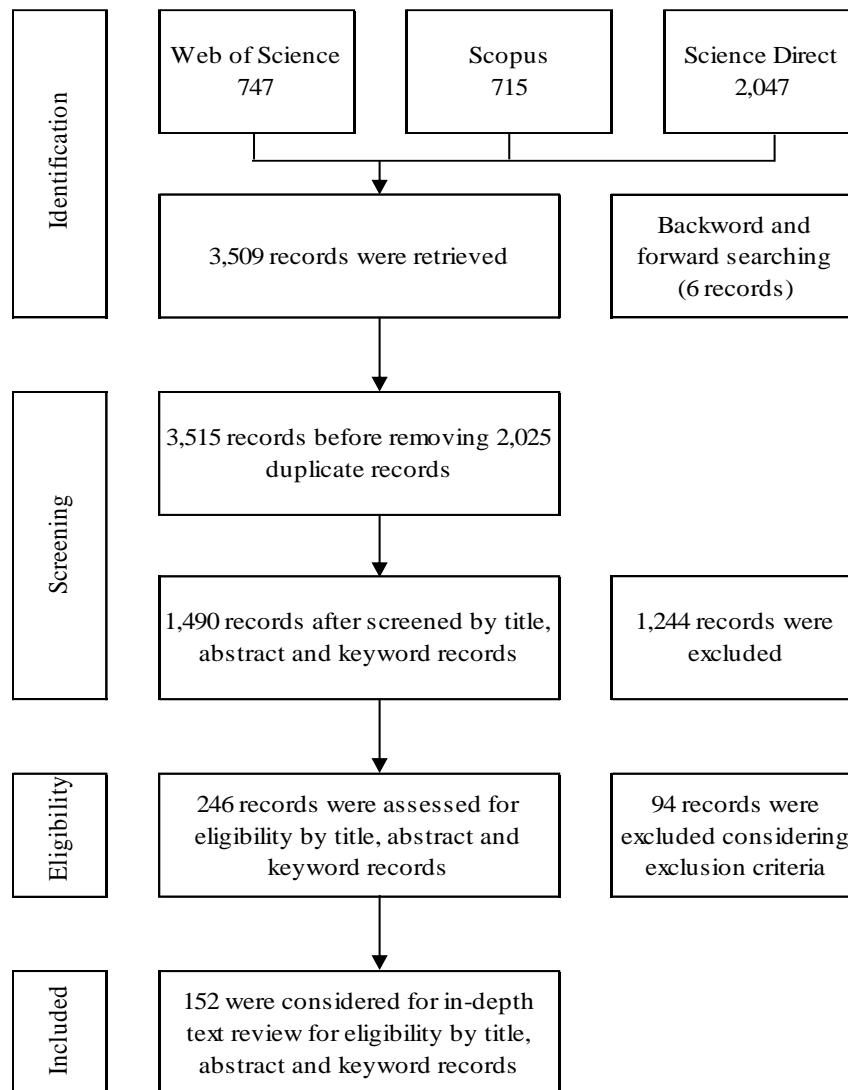


Fig. 1 - The PRISMA flowchart of screening process

4. Synthesis of Results

The first stage of synthesizing the 152 literatures is dividing them according to 2 classifications, literatures from the developed countries and literatures from developing countries as presented in Table 2 & 3.

Table 2 - Articles reviewed from developed countries

Developed Countries	Articles	References
United States	12	(Gilbert et al., 2017; J. J. Kim et al., 2020; Membah & Asa, 2015; Moret & Einstein, 2016; C. Ramanathan et al., 2012; Safapour & Kermanshachi, 2019; P. Shrestha & Behzadan, 2018; P. P. Shrestha et al., 2019; P. P. Shrestha & Maharjan, 2018; P. P. Shrestha & Neupane, 2020)
Australia	5	(Doloi, 2013; P. E.D. Love et al., 2017; Peter E. D. Love et al., 2017; Peter E.D. Love et al., 2015, 2017; Petheram & McMahon, 2019)
Denmark	4	(Gilbert et al., 2017; Larsen et al., 2016; Sovacool, Gilbert, et al., 2014; Sovacool, Nugent, et al., 2014)
Italy	3	(Beria et al., 2018; Cavalieri et al., 2019)
Norway	3	(Belay & Torp, 2017; Teigen et al., 2019)
United Kingdom	3	(Dominic & Smith, 2014; Gilbert et al., 2017; Peter E.D. Love et al., 2018)
Canada	2	(Robu et al., 2018)
Netherlands	2	(Cantarelli et al., 2012; Hosseini et al., 2016)

Spain	2	(Ballesteros-Pérez et al., 2020; Beria et al., 2018)
Sweden	2	(Adam et al., 2017; Lind & Brunes, 2014)
Others	6	(Bauer et al., 2017; Makovšek, 2014; Paraskevopoulou & Benardos, 2013; Plebankiewicz, 2018; Tijanić et al., 2020; Zhao et al., 2019)

Table 3 - Articles reviewed from developing countries

Developing Countries	Articles	References
India	22	(Afzal et al., 2019; Anish et al., 2019; Bhangale, 2016; Chandramohan et al., 2012; Cindrela Devi & Ananthanarayanan, 2017; Ghumare et al., 2019; Kant, 2018; Muthu Venkata Sekar & Mahalakshmi, 2018; Pai et al., 2018; Raju et al., 2017; Shaktawat & Vadhera, 2017; Shanmuganathan & Baskar, 2015; Sharma et al., 2020; Sharma & Goyal, 2019; Shrivastava et al., 2019; Subramani et al., 2018; Subramani & Sivakumar, 2018; Velumani & Nampoothiri, 2019; Venkateswaran & Murugasan, 2017; Wanjari & Dobariya, 2016)
Malaysia	20	(Abdullah et al., 2018; Afzal et al., 2019; Akram et al., 2017; Asmi et al., 2013; Azis et al., 2013; Hameed Memon et al., 2014; Haslinda et al., 2018; Ismail et al., 2013; Karunakaran et al., 2018; Liew et al., 2019; Memon et al., 2011, 2012; Memon & Rahman, 2014; Rahman et al., 2013; C. Ramanathan et al., 2012; C. T. Ramanathan et al., 2011; Shehu, Endut, & Akintoye, 2014; Shehu, Endut, Akintoye, et al., 2014)
Pakistan	9	(Afzal et al., 2019; Akram et al., 2017; Choudhry et al., 2014, 2018; Choudhry & Rehman Nasir, 2012; Hanif et al., 2016; Maqsoom et al., 2018; S. Sohu et al., 2017; Samiullah Sohu et al., 2017; Zafar et al., 2016)
China	6	(Afzal et al., 2019; Lou & Yin, 2010; Ma, 2011; Mansur et al., 2019; Wang & Yuan, 2011; Yuanyue & Huimin, 2018)
Ghana	5	(Asiedu et al., 2017; Asiedu & Adaku, 2019; Coffie et al., 2019)
Nigeria	4	(Akinradewo et al., 2019; Akinsiku et al., 2014; Amadi & Higham, 2019; Amusan et al., 2018; Hingham, 2016)
Saudi Arabia	4	(Alghonamy, 2015; Mahamid, 2013, 2018; Seddeeq et al., 2019)
South Africa	4	(Khabisi, 2012; Monyane et al., 2018; Mulalo et al., 2018; Ramabodu & Verster, 2013)
UAE	4	(Al Hosani et al., 2020; Johnson & Babu, 2020; Zahmak et al., 2020)
Iran	3	(Derakhshanalavijeh & Teixeira, 2017; Mohammad et al., 2016)
Developing Countries	Articles	References
Korea	3	(Jung et al., 2016; Kavuma et al., 2019; Qiao et al., 2019)
Vietnam	3	(S. Kim et al., 2017; S. Y. Kim et al., 2018; Pham et al., 2020)
Others	21	(Afzal et al., 2019; Al-hazim et al., 2017; Alzebdeh et al., 2015; Apolot & Tindiwensi, 2013; Bayram & Al-Jibouri, 2018; Cabuñas & Silva, 2019; Cheng, 2014; Durdyev et al., 2017; Huo et al., 2018; Islam et al., 2019; Kuljaroenwirat & Seresangtakul, 2016; Lin & Techapeeraparnich, 2019; Pilger et al., 2020; Polat et al., 2014; Senouci et al., 2016; Shan et al., 2017; Sinesilassie et al., 2018; Susanti, 2020)

Based on the concepts that arise from the first stage of synthesis, the author proceeds to the second stage where the literatures were grouped into types of construction projects as presented in Figure 2 & 3.

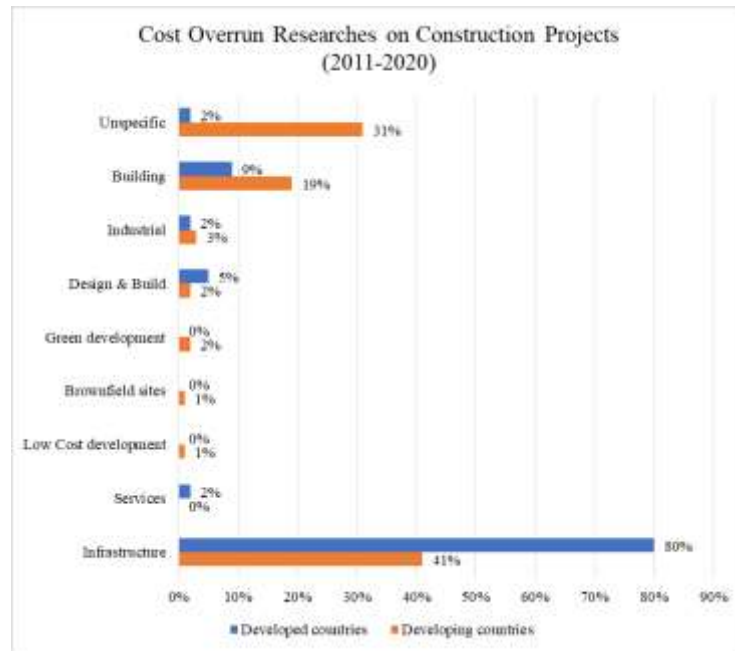


Fig. 2 - Cost overrun research on construction projects (2011-2020)

The data in Figure 2 shows a significant difference between developed and developing countries. Developing countries spent a considerable effort on studying cost overrun from unspecific type of projects (31%).

Besides that, there is a slightly more study on and building projects (19%) and industrial projects (3%). The result is plausible due to the remarkable shortage of buildings in developing countries both in residential as well as infrastructure (Kant, 2018) and industrial development has also been established by scholars as the main drive of economic growth (Kniivilä, 2004).

In contrast, developed countries spent considerably less effort on studying unspecific projects (2%), slightly less effort on building projects (9%) and also industrial projects (2%). There has also been no study on unique projects compared to the developing nations which have conducted research on green development (2%), brownfield sites (1%) and low-cost development (1%). Nevertheless, the developed countries have spent a slightly more effort on design and build projects (5%) and services (2%).

However, both of the developed and developing countries have expended a substantial effort on studying cost overrun of infrastructure projects albeit the developed countries spent almost double the effort (80%) compared to developing countries (41%). Due to the diverse types of infrastructure projects, another assessment has been done as shown in Figure 3.

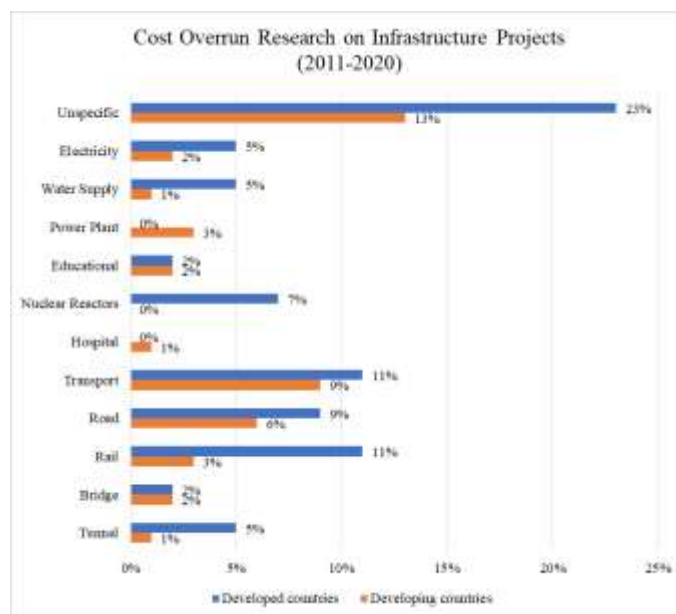


Fig. 3 - Cost overrun research on infrastructure project (2011-2020)

Referring to Figure 3, out of the 80% research on cost overrun in infrastructure projects in developed countries, a significant 23% was spent on unspecific type of infrastructure, followed by 11% on transport and rail projects. 9% from road projects, 7% from nuclear reactors (United States and United Kingdom only), 5% from electricity, water supply and tunnel projects and 2% on bridges and educational projects.

On the other hand, developing countries spent mostly less effort in all the types of infrastructure projects except power plants (3%) and hospital (1%) while the developing countries have not done any study on them. Nonetheless, they spent an equal percentage of research on educational projects.

5. Analysis and Discussions

The result has shown a notable difference in pattern of research in cost overrun studies between developed countries and developing countries.

Developing countries have spent a large effort on studying cost overrun however on unspecific projects. Despite finding various components in cost overrun from construction participants, the studies did not specify the type of construction projects that they address to. These researches are produced in high quantity but they are low in quality due to their lack of specificity. Considering the uniqueness of each of the diverse construction projects, there are abundant factors behind this diversity (Ballesteros-Pérez, et al., 2017) and each project contains a unique set of construction risks (Sovacool, Nugent, et al., 2014). Therefore, to gain a meaningful result, each project type should be studied separately (Kim et al., 2020).

There is also a slight difference in the focus of cost overrun research between the 2 nations. For instance, a few researches were found to be focusing on a category of procurement (design and build), a specific nature of projects (green development & brownfield sites), and types of projects (low-cost development and services projects). However, they are not considered in this study as it can be accepted that each country possesses different characteristics, challenges and therefore different requirements in the construction industry (Ofori, 2019).

The major difference of cost overrun studies exists in infrastructure projects. 80% out of the 44 articles from the developed countries have focused on infrastructure projects whereas there is only 41% out of the 108 articles from the developing countries have studied cost overrun in infrastructure projects.

According to Strauss (2001), the difference between developed countries and less developed ones is that the latter regularly have to put up with inferior public infrastructure and possess insufficient domestic monetary supply. The statement substantiates the finding that the developed countries have concentrated their research on infrastructure projects as they have made substantial investment in national infrastructure compared to the developing countries.

Diving deeper, there are various forms of infrastructure development (Ochieng et al., 2017), and the review showed that transport infrastructure has received the highest emphasis in the cost overrun research by both the developed (11%) and developing countries (9%). The issue was initially highlighted by Flyvbjerg, et al. (2003) where it was highlighted that nine out of ten transport infrastructure projects fall victim to cost escalation. Various researchers were then starting to explore the issue of cost overrun in transport in different countries and different transport projects.

The famous research by Flyvbjerg, et al. (2003) also revealed that out of the many types of transport infrastructure projects, rail projects came across the highest average cost escalation (45%) compared to fixed links (34%), roads (20%) and other projects types (28%). Flyvbjerg, et al. (2003)'s finding is coherent in this study, where it was indicated that developed countries spent a significantly high amount of research on rail projects (11%) followed by road projects (9%). Developing countries also spent almost similar focus albeit a bit fewer in number. Besides that, bridge and tunnel projects are also receiving attention in proportion to them being a part of road and rail projects.

Numerous researchers have studied on the issue of cost overrun in transport infrastructure projects (Cantarelli et al., 2012; Doloi, 2011; Eyboosh et al., 2011; Fang and Marle, 2013). Several risk assessments models have also been utilized to identify the unique factors that causes cost overrun (Olaniran et al., 2017; Qazi et al., 2016; Satiennam et al., 2006). Unfortunately, the issue persists because of the unique character of different construction projects (Tabei et al., 2019; Yuan et al., 2018).

The findings from this study had uncovered new directions of construction cost overrun research for researchers in developing countries. The current domain of research from the developed countries should be a highlight for developing countries to envisage the future domain of their countries. This information could be utilized by the current and future researchers in mapping their direction and further justifying the significance of their research.

6. Conclusion

Through the years, there has been numerous researches addressing the issue of cost overrun in the construction industry. However, the issue seems to persist. Therefore, the aim of the review is to review the current cost overrun research and explore the distinction between cost overrun studies in the developed nations and the developing nations.

The systematic review has identified difference between the 2 nations in the domain of research on cost overrun. Developing nations have spent comparable studies on cost overrun to the developed nations. However, majority of their efforts are not directed to any specific type construction while developed nations are observed to be moving forward to a more specific construction project.

The project that has received significant emphasis on research from the developed nations is infrastructure construction projects, particularly rail infrastructure projects. It has received significant attention of researchers from

developed and developing countries albeit being more from the developed countries due to their large investment that they have spent in it.

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