

PRODUCTIVITY FACTORS IN CONSTRUCTION SMEs IN OMAN- EXPLORATION STUDY

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ABSTRACT: Construction projects are unique and influenced by many external and internal factors hindering the efficiencies of operations. Different construction companies may have different influencing productivity factors depending on the company's scale. Large construction companies have better resource management systems than the construction small and medium enterprises (SME). The construction SMEs work in small scale projects, and the amount and type of the required resources are different from the large construction companies. Therefore, identifying the factors affecting construction productivity is essential to determine the best action to avoid any unforeseen productivity reduction. This study aims to rank the most influencing productivity factors in small and medium construction (SME) companies. A questionnaire survey was used to collect data from small and medium construction companies registered in Oman Tender Board. The relative importance index (RII) was used to evaluate the responses. Sixty-five companies out of the 207 targeted population participated in the survey. It was found that - incomplete drawings and drawing omissions, poor site condition and management, delay in payment, unavailability of proper tools and equipment, and workers absenteeism and turnover were found as the top factors that influence construction productivity.

Keywords: Construction; Productivity; RII; Oman; SMEs

عوامل الإنتاج في المقاولات الصغرى والمتوسطة في عمان- دراسة استكشافية

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المخلص: تتأثر مشاريع البناء بالعديد من العوامل الداخلية والخارجية التي تعوق كفاءة عمليات البناء. وقد يكون لشركات البناء المختلفة تأثير مختلف لكون شركات البناء الكبرى لديها أنظمة لإدارة الموارد أفضل من المؤسسات الصغيرة والمتوسطة، كما أن كمية ونوع الموارد المطلوبة تختلف بحسب إمكانات الشركة. يعد تحديد هذه العوامل ضرورياً لتحديد أفضل الممارسات لتجنب أي انخفاض غير متوقع في إنتاجية البناء. هدفت هذه الدراسة إلى تصنيف عوامل الإنتاجية الأكثر تأثيراً على شركات المقاولات الصغيرة والمتوسطة. تم استخدام استبيان لجمع البيانات من شركات المقاولات الصغيرة والمتوسطة المسجلة في مجلس المناقصات العماني. تم استخدام مؤشر الأهمية النسبية (RII) لتقييم الردود. شارك في المسح 65 شركة من أصل 207 مجموعة مستهدفة. تبين أن الرسومات غير المكتملة والأخطاء في الرسم، وسوء حالة الموقع وإدارته، والتأخير في الدفع، ونقص الأدوات والمعدات، وتغيب العمال واستقالاتهم، من أكثر العوامل التي تؤثر على إنتاجية البناء في مشاريع الشركات الصغيرة والمتوسطة العاملة في قطاع التشييد.

الكلمات المفتاحية: بناء؛ إنتاجية؛ RII ؛ سلطنة عمان؛ الشركات الصغيرة والمتوسطة

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1. INTRODUCTION

The construction industry has a substantial impact on the international and local economies. In Australia, the construction industry contributes about \$360 billion in revenue and grows around 9% of the Gross Domestic Product (GDP). It has a projected annual growth rate of 2.4% from 2020 until 2025 (Australian Industry and Skills Committee, 2020). In Malaysia, the industry has been contributing between 3 to 5 % of the GDP (Ali Khan, Shahir Liew, and Bin Ghazali, 2014). Also, India's construction industry (real estate and urban development) produced about \$ 5 billion in revenues, and its contribution to the Indian GDP was 9% (Padia, 2020). While the Omani construction market is expected to generate 6% of the compound annual growth rate (CAGR) over the period between 2019 and 2024 (Intelligence, 2020). This forecast is translated by the 2,410 active construction projects in Oman, with a value of over USD 190 billion (Intelligence, 2020).

Omani Construction industry market varies in enterprises standards and contributing to the industry. Mainly, the dominant enterprises in the Omani market are the small and medium (SMEs).

The prominent appearance of SMEs in the construction industry is due to their low investment head compared to other enterprises (Bevan and Yung, 2015). SMEs presents a pivotal role in the economic growth of the country, and it also contributes toward improving the quality of life and living standards.

The construction industry SMEs face many challenges. The challenges may be related to different project characteristics and requirements such as the project location, project complexity, required resources, project time requirements etc. (Azis, Memon, Abdul Rahman, Nagapan, and Qadir, 2012). Also, high competition opposes some challenges, such as the shrinkage of the profit margins. Some other challenges can be related to some groups with different controlling factors such as labour and human-related factors, financial, administrative/managerial, and planning groups (Almathami *et al.*, 2017). All of these groups have a direct relationship with construction productivity. It may negatively affect construction productivity and may negatively influence the construction project cost, time, and quality. Occupational health and safety practices can also affect construction productivity (Al Mawil *et al.*, 2021). Thus, SMEs are characterized by a high failure rate caused by many factors, such as low productivity (Adebowale and Agumba, 2021). Therefore, it is essential to identify productivity controlling factors.

The construction productivity term is defined as the ratio of production output to what is required to produce, such as resources used to generate the production output (Intergraph, 2012). In addition, productivity is defined as the total output ratio to the entire input (Whiteside, 2006). The production rates help to conduct a relative level of productivity determination. A production rate in the construction

industry is when workers are expected to complete a defined task given a set of resources (Guntuk and Koehn, 2009). The production rate depends on the time at which workers are expected to finish the assigned task according to the work specification. Thus, the evaluation and analysis of the productivity factors help develop the construction industry by averting low productivity project environments.

The construction industry in many different countries is experiencing growth and challenges at the same time. Some of the challenges are related to maintaining a production rate suitable to achieve the project's goals. However, construction productivity performance is controlled by different factors, and it is essential to identify these factors to allow for better development in project planning and control. Therefore, this study aims to investigate the construction productivity factors in Omani construction SMEs.

2. LITERATURE REVIEW

Many researchers agree that productivity is one of the essential variables at which production activities are evaluated and monitored. Several researchers have also declared that to maintain a competitive production level. This section discusses different previous researches in the area of construction productivity. The resources collected are semi-structured according to the geographical location of the study.

Hughes and Thorpe (2014) investigated the construction productivity enabling factors in the Australian construction industry. A structured questionnaire survey was used in the study and was distributed to construction project managers. The study concluded that the rework was the most construction productivity-hindering factor followed by an incompetent supervisor, incomplete drawings. The investigation was conducted by a structured questionnaire survey sent to several random construction project managers. They concluded that rework, incompetent supervisor, incomplete drawing, labours work overload and unavailability of materials are the most influencing productivity factor.

Factors relating the labour productivity to the project schedule performance in Indonesia were studied by Soekiman (2011), who investigated the labour productivity factors that affect the project schedules in the Indonesian construction industry. The study was made through a questionnaire survey distributed to respondents who manage various types of construction projects within large, medium and small companies. The results showed that incompetent supervisors issuing unclear instructions to labours is the most influencing productivity factor. The unavailability of materials, the financial status of the client, and the unavailability of definite schedules are also major productivity factors.

Jaafar (2005) investigated the factors affecting

construction labour productivity in Malaysian residential projects. The data were obtained through a questionnaire survey, and a total of 100 respondents were collected from contractors, developers, and consultants. It was found that the unavailability of materials was the most critical productivity factor followed by the delay in payment, late issuing of shop drawings, and poor construction management.

Pornthepkasemsant and Charoenpornpattana (2019) identified the factors affecting construction productivity in Thailand's construction industry. They identified the following factors as the most influential productivity factors: (1) lack of labour, (2) lack of experienced labours, (3) incomplete drawings, (4) inefficient communication with the engineer, and (5) financial difficulties.

On the other hand, Tuan Hai (2019) analysed the affecting factors on construction productivity in Vietnam. The data were obtained through a survey and recognized the following vital determinants: construction workers' motivations, working tools, the organization and management of the onsite production and labour safety.

Dixit (2017, 2018) investigated the construction productivity factors in the Indian construction industry. The data were collected by a structured questionnaire survey distributed to a group of professionals working in the Indian construction industry. It was found the company's management lack of decision-making skills was a crucial productivity determinant. Also, poor planning and controlling, inefficient logistics and supply chaining management systems, and unavailability of labours have a substantial effect on construction.

Golchin and Kim (2018) studied factors affecting the construction labour productivity in the Iranian construction industry. The study found that rework was the most influencing productivity factor. Delay in payment, unavailability of equipment and tools and incomplete drawings were also major construction productivity factors. Similarly, Ghoddousi and Poorafshar (2015) investigated labour productivity in Iranian construction projects. The study targeted sixty chief executive officers. It was found that the salary and incentives, delay in payment, and the ethical behaviour of managers influence construction productivity.

Al-Rubaye and Mahjoob (2020) identified the main factors affecting labour productivity in different Iraqi construction companies. It was found that construction site management, site accessibility, terrorist attacks, and the financial challenges of the contractor are major construction productivity factors. Khaleel and Nassar (2018) also studied and analysed the factors affecting labour productivity in the Iraqi construction industry. Data were collected from different sources such as site surveys, interviews with engineers and experts, and previous research in the Arab region. The unavailability of materials was found the most influencing productivity factor followed by weather

conditions, political issues, and stability and security.

In the Jordanian construction industry, the construction productivity factors were investigated by Hiyassat *et al.* (2016). A questionnaire survey was sent to 200 engineers/foremen who work in the construction industry—the most influencing productivity factor labours experience. Financial challenges, inefficient communication between engineers and labours, and poor work scheduling were also considered major construction productivity factors.

Shurab (2018) conducted a questionnaire survey to evaluate the effect of a motivational factor on the construction project managers in Jordan. Shurab (2018) found that the wage rate, personal development opportunities, and rewards have a direct relationship with construction productivity. Al-Abbadi and Agyekum-Mensah (2019), on the other hand, also evaluated the effects of motivational factors on the construction professional's productivity in the Jordanian construction industry. A questionnaire survey and semi-structured interviews were used to collect the data. It was found that personal/career development and on-time payment and rewards and incentives, wage rate, and respect contributes positively toward improving construction productivity.

El-Gohary and Aziz (2014) explored the influencing factors to construction labour productivity in the Egyptian construction industry, and it was found that the labour skill and experience, competence of construction manager, incentive programs and the availability of materials are major construction productivity factors.

Factors influencing productivity in the construction industry in Saudi Arabia's kingdom were studied by Almathami *et al.* (2017). The results showed that the financial situation of the client and the contractor, project site-related factors and the availability of materials and equipment are influencing construction productivity factors.

Mahamid (2013) investigated the contractor's perspective toward factors affecting labour productivity in building construction in Palestine. A structured questionnaire survey was used to collect data from contractors working in building construction. The results showed rework as the most influencing construction productivity factor followed by the communication between the project's parties, the client's financial status, labour experience, and lack of materials.

Enshassi (2014) investigated the productivity factors of the Palestinian construction craftsmen. A structured questionnaire survey was distributed to many of the construction craftsmen. The results indicated that the highest-ranking productivity factors are the availability of materials, safety, delay in payment, inspection delays, low wages, and lack of craftsmen experience.

In the context of the Yemeni construction industry, Alaghabari *et al.* (2018) studied labours construction productivity. It was found that the experiences level of

labour, materials availability, site management, and political stability were considered the most influencing construction productivity factors.

Jarkas *et al.* (2015), on the other hand, explored the labours productivity factors in Bahrain's construction industry. A structured questionnaire survey was used to collect the data. It was found that the coordination between different design disciplines, incompetent site supervisors, design errors and omissions, delay in responding to contractor's requests for information and labour skills and experience are the most influencing construction productivity factors. Similarly, Jarkas and Bitar (2012) studied the construction labour productivity factors in Kuwait and used a structured questionnaire survey to collect the data from a group of contractors. The analyses of the data recognized that the clarity of specifications, coordination among different design disciplines, the proportion of work subcontracted, change orders, and lack of labour supervision were the most influencing construction productivity factors.

Jarkas *et al.* (2015) investigated the construction labour productivity in Oman. A questionnaire survey was distributed to the top contractors registered in Oman's Tender Board. It was found that change orders, design errors and omission, incompetent labour supervision, delay in responding to requests for information contribute to construction productivity. Jarkas *et al.* (2012) studied the same in the context of the Qatari construction industry. A structured questionnaire survey was also used to collect data and concluded that the communication between site management and labour, labours experience and skills, availability of materials are the productivity influencing factors.

Factors affecting employee productivity In the United Arab Emirates (UAE) construction industry were investigated by Ailabouni *et al.* (2009). The study was carried out by distributing a questionnaire survey. The results identified the following factors as most significant: proper work timings, balancing work and recreation, time with family, leadership skills of supervisors, payment, and technical competency.

Based on the above literature review, the construction productivity factor area of research was well established globally and regionally. However, the study didn't take into consideration small and medium construction companies. The reason is maybe because of the challenge related to the communication with these companies.

3. PROBLEM STATEMENT

Construction is a crucial activity within any economy, given its contribution to any economic prospects' gross domestic product. Fulfilling good quality construction projects within the required period is accomplished by maintaining a high productivity working environment. Productivity is a significant determinant in construction industry projects. Productivity level and

efficiency are affected by various factors such as rework, incompetent supervisor and drawing, work overload, and lack of material, increasing the construction project's financial risks. Hence, improving construction productivity can be performed through the identification of the productivity retaining factors. Besides, it is essential to identify these factors and rank them according to their effectiveness on construction productivity. Therefore, this study aims to identify factors affecting the productivity of the Omani construction industry. This study aims to identify the acquirer construction companies' productivity factors and contractors who contribute locally in the small and medium construction projects. Analysing the productivity factors, challenges and consequences for these companies and contractors will produce a clear insight into the Omani construction market.

4. METHODOLOGY

The relevant data for this investigation were collected based on related previous studies on construction productivity. See Table 1; twenty-one factors were collected from those studies. The selection of these factors was based on their frequency of appearance in the literature. This fact is considered a limitation, and the future direction of the study is to identify the predominant productivities factors affecting the construction SMEs.

A questionnaire survey was prepared using "Google Form", and it contains two parts. The first part covers the participant's demographic information, and the second part captures the participant's perception of the construction productivity factors surveyed.

Table 1. Productivity factors surveyed.

No.	Productivity Factors
1	Delay in payment
2	Construction method
3	Unrealistic time and cost estimate
4	Work supervision
5	Effectiveness of communication protocol (i.e. clarity of instructions, delay in responding to Request for Information (RFI))
6	Incomplete drawings or drawings omission
7	Overcrowding
8	Lack of materials
9	Lack of proper material handling and storage
10	Lack of tools and equipment
11	Accidents
12	Change orders
13	Inspection delay
14	Workers absenteeism and turnover
15	Poor site conditions and management
16	Site accessibility
17	Planning and workflow
18	Labours skills and experiences
19	Weather effect
20	Project specifications
21	Rework

Five points Likert scale is used in the questionnaire survey. These points are (5) Extreme Effect, (4) Substantial Effect, (3) Moderate Effect, (2) Minor Effect, and (1) No Effect. The data collected will be analysed using the relative importance index (RII) technique. The relative importance index is calculated using the following formula:

$$RII = \frac{5(n_5)+4(n_4)+3(n_3)+2(n_2)+n_1}{5(n_1+n_2+n_3+n_4+n_5)} \times 100 \quad (1)$$

where: $n_1, n_2, n_3, n_4,$ and n_5 = the number of respondents who selected: 1, for No Effect; 2, for Minor Effect; 3, for Moderate Effect; 4, for Substantial Effect; and 5, for Extreme Effect, respectively.

The target population of the study are the construction companies registered in Oman Tender Board. The other criterion used is that the registered construction company should be classified as small and medium-sized enterprises (SME). Accordingly, the number of construction SMEs registered in the Oman Tender Board were 207(2020). To obtain a statistically representative sample of the population, Eqn. (2) was used as follows:

$$n = \frac{m}{1 + (\frac{m-1}{N})} \quad (2)$$

where,

n = the sample size of the limited population,
 m = the sample size of the unlimited population
 N = the sample size of the available population, respectively. m is estimated by Eqn. (3):

$$m = \frac{z^2 \times \rho \times (1-\rho)}{\epsilon^2} \quad (3)$$

where,

z = the statistic value for the confidence level
 p = the value of the population proportion that is being estimated, obtained to be 0.50.
 ϵ = the sampling error of the point estimate.
 m , is approximated as follows:

$$m = \frac{(1.96)^2 \times 0.5 \times (1 - 0.5)}{(0.05)^2} \approx 385$$

Accordingly, the representative sample size of the population required is determined as shown below:

$$n = \frac{385}{1 + (\frac{385 - 1}{207})} \approx 135$$

5. DISCUSSION OF RESULTS

The questionnaire survey was distributed to 207 small and medium construction companies registered in the Oman tender board. The data collection processes extended for three months, and Sixty-five responses were received, representing 48% of the representative

sample. Table 2 below shows the demographic information of the respondents. The majority were Omanis, and males represent 86% of the total respondents. Fifty-one per cent of the respondents are within the 25-35 age range, and the majority hold a BSc degree. Also, 57% of the respondents represent the job title “Manager”. However, some of the respondents have written their job title as “Company Owner”, and it is known that it is not a job title. The majority of the small and medium construction companies’ owners run their businesses. Therefore, it is assumed that the company owners are considered managers. Regarding the working experiences, the majority of the respondent’s work experience is under 15 years.

Figure 1 below shows the relative importance indexes (RII) for the surveyed construction productivity factors. The higher the value of the RII, the more the influence of the construction productivity factor is considered by the small and medium construction companies. Incomplete drawings or drawings omissions were found the most productive factor influencing the construction work, and work supervision were found the least influencing productivity factor. Incomplete drawings or drawing omissions are managerial aspects and are supposed to be resolved during the cost estimating. The contractor is expected to inquire about any missing information; however, the small and medium construction companies use a unit rate cost estimating technique to price the project without even looking into the drawing’s specifications. That is why the incomplete drawings and drawings omissions scored high, from the authors' point of view.

Table 2. Demographic information.

No	Demographic Information	%
1	Nationality	Omani 97
		Non-Omani 3
2	Gender	Male 86
		Female 14
3	Age	25-35 51
		36-46 29
		46-55 18
		>55 2
		MSc/MEng 8
		BSc 49
5	Job title	Diploma 37
		Other (Primary education and high school) 6
		Manager 57
		Engineer 25
		Site superintendent 5
6	Work experience (years)	Other (Company Owner) 14
		< 5 23
		5-10 29
		11-15 20
		16-20 15
		>20 12

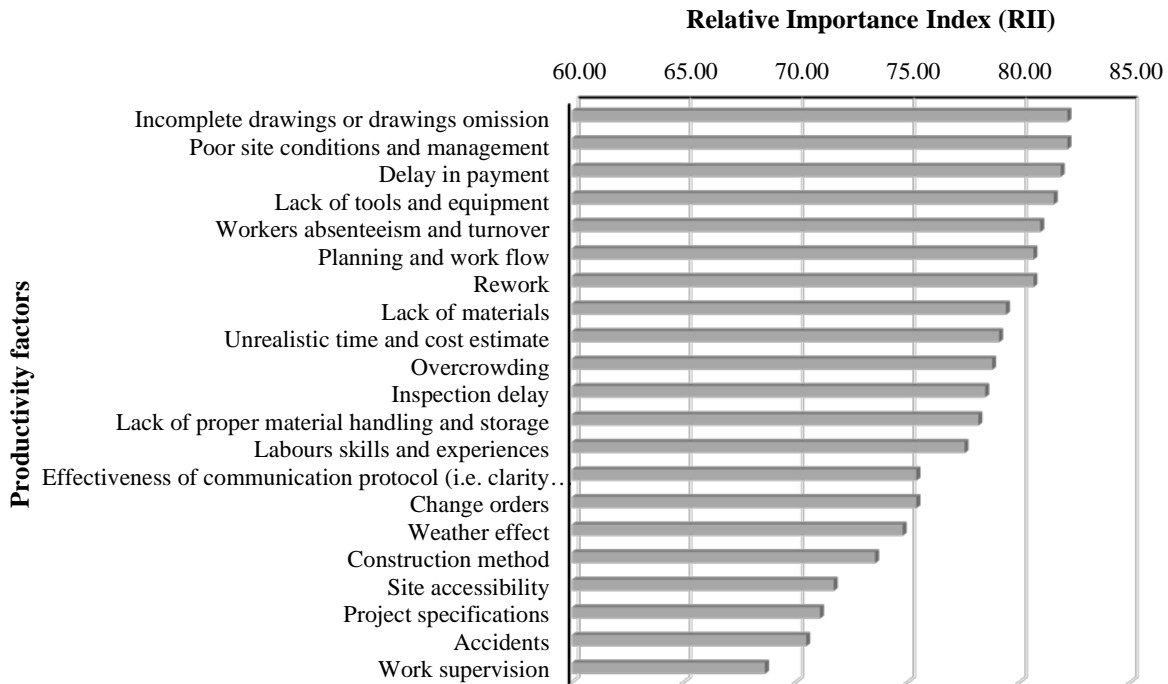


Figure 1. Relative importance indexes (RII) for the surveyed productivity factors.

Poor site conditions and management, lack tools and equipment, workers’ absenteeism and turnover, and planning and workflow are among the top influencing construction productivity factors, which can be correlated to the delay in payment. Small and medium construction companies rely on subcontractors to do some specialized work such as repairing, mechanical, electrical and plumbing (MEP), and finishing works. Suppose poor management of resources and delay in payment is experienced in the project. In that case, it is expected these factors will exert a dominos effect, which means that all be affected and may express the same results.

Many different factors usually cause rework. For example, drawing omissions, lack of proper quality control, and lack of supervision may cause rework. The rework scored high (above 80%). This result is driven by the fact that incomplete drawings and drawings omission were ranked first.

The lack of materials, unrealistic time and cost estimate, and overcrowding 8th, 9th, and 10th, respectively. These factors are related to resources management, and it can be seen that the small and medium construction companies may have management issues.

The weather effect, construction method, site accessibility, project specification, accidents were found among the least influencing construction productivity factors. This result is expected since the small and medium construction companies usually involve building small manageable projects. Also, they are sometimes managed by a primary large construction company in case they work as subcontractors.

6. CONCLUSION

Maintaining planned construction productivity levels is essential to achieve the projects’ milestones. However, construction productivity is influenced by many factors, including managerial, technological, or labour factors. It is necessary to identify the most influencing construction productivity factors to better plan construction activities. Many previous studies identified the most influencing construction productivity factors affecting large construction companies, and this study focused on small and medium construction companies working in the Omani construction industry. The study found that incomplete drawings and drawing omissions most influence construction productivity, followed by poor site conditions and management. The delay in payment, the financial aspect of the construction productivity factor, was ranked third.

The technical problem in drawings omissions is the dominant productivity hindering factor for construction SMEs; however, most of the highly ranked factors belong to the management aspect. This finding highlights the need for construction SMEs to improve their organizational management efficiency. The future extension of this study is to cover more small and medium construction companies to allow the findings of this study to be generalized in the Oman construction industry.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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