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THE HUMAN FACTORS AFFECTING CONSTRUCTION PRODUCTIVITY IN THAILAND

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ABSTRACT: A variety of factors influence productivity in construction projects. The human factor is one of the issues concerning the decline in productivity rates. This study aims to identify the human factors affecting construction productivity in Thailand. Data was collected through questionnaire surveys and project site visits, along with interviews with three site supervisors. The respondents were 104 engineers working in the construction industry in Thailand. The factors were ranked by Relative Importance Index (RII). The top five factors affecting construction productivity are (1) adequate personnel safety equipment, (2) salaries on time, (3) short interval planning and progress tracking in the construction site (4) recruitment and segmentation of worker skills, and (5) problem-solving skills. In addition, the interviews with site supervisors indicated that the labour productivity of bricklayers was approximately 1.2 square meters per hour per person. Multiple factors contributing to lower productivity were discovered, including a lack of competent labour, a lack of supervision that compromised building quality, inadequate work planning, and the unavailability of suitable tools. The results from both questionnaires and interviews have shown a significant level of consistency, so affirming the reliability of the findings. In conclusion, for construction projects to attain good outcomes, organizations must deploy workers with adequate knowledge, skills, and experience. Such professionals are vital for methodical planning and competent supervision, both of which are crucial for improving labour productivity and maintaining performance enhancements in the construction industry.

Keywords: Human factors, Productivity, Construction projects, Thailand

1. INTRODUCTION

The construction industry is a key economic sector driving national growth through infrastructure development, job creation, and public and private investment [1]. In 2024, Thailand's construction industry sector was estimated at approximately USD 106.77 billion [2]. Continued expansion to large-scale infrastructure projects and the establishment the Eastern Special Development Zone (ESDZ), highlighting the sector's strategic importance for national competitiveness and long-term sustainable development [2,3]. Despite this growth, Thailand's construction productivity remains relatively low compared to that of advanced economies [4]. The productivity of Thai contractors has not kept pace with revenue growth, indicating structural constraints in the utilisation of labor and capital [5]. These challenges result in cost overruns, construction delays, and quality deficiencies, which collectively undermine project-level performance and the overall efficiency of the industry [6].

Construction labour productivity can be examined using several conceptual frameworks that classify factors into four groups, including project management factors, technology and equipment factors, human factors, and external and environmental factors.

Project management factors include project planning and scheduling, site control, quality of supervision, coordination among project participants, management of materials and equipment, responsiveness to requests for information, and the management of change orders [6]. Many studies highlight that the competencies of project managers and site managers, along with the quality of short-term planning and monitoring, significantly affect the work continuity and the productive deployment of labour on site [7].

Technology and equipment factors encompass the selection between traditional cast-in-place and industrialised or off-site construction methods, the extent of digitalisation through tools such as Building Information Modelling (BIM) and automation, the availability and condition of machinery and tools, and the efficiency of material supply chains [8,9]. Research across various contexts demonstrates that material delivery delays, insufficient or poorly maintained equipment, and limited adoption of modern construction methods increase unproductive time and disrupt workflow, thereby reducing effective output per worker-hour [8,9]. In Thailand, traditional on-site methods continue to account for more than 80% of the contractors. Although technologies such as precast systems, modular construction, 3D printing, and Building Information Modelling (BIM) are receiving increased attention, their adoption remains limited, thereby resulting in short-term productivity

improvements at the sectoral level [10].

Human factors are recognized as particularly influential in construction productivity. These factors encompass workers' skills and experience, work discipline, motivation, physical and mental well-being, safety attitudes, teamwork, leadership, and communication [6,7,9]. Studies conducted across various regions consistently identify worker experience and skills, motivation, competent supervision, and effective communication between supervisors and workers as the most important and highly ranked of labour productivity factors [11]. Additionally, research on job well-being in construction demonstrates that income, job security, perceived safety, working hours, and work-related stress significantly influence productive performance and the likelihood of unsafe behaviors [12]. This evidence links human factors to both productivity and occupational health and safety outcomes.

External and environmental factors, such as macroeconomic conditions, labour market conditions, regulatory and contractual requirements, climatic conditions, material price volatility, political conditions, and business culture should be mentioned [7]. Although these factors are generally beyond the direct control of project managers, they shape project risk profiles, cost structures, investment decisions, and workflow processes [13]. Consequently, they indirectly affect productivity through schedule delay, rework, and changes in resource allocation.

Recent analyses of construction productivity indicate that sustainable improvements require not only technological advancements but also enhancements in labour management, site supervision, and organizational support systems [14]. Empirical studies have demonstrated that insufficient safety equipment, delayed wage payments, inadequate training, and weak site control negatively affect labour productivity by lowering morale and diminishing productive work intensity, even when modern tools and methods are present [15]. Ineffective short-term planning and limited monitoring of work progress frequently result in wasted time, inefficient task sequencing, and work discontinuities, particularly in labor-intensive operations [14,15]. These factors exacerbate productivity losses and increase the risk of cost overruns.

Human resource management is widely regarded as the most complex aspect of productivity improvement, as many delays and major accidents from human error associated with deficiencies in leadership, management, operations, or maintenance. Previous studies on human-centred productivity emphasize the need for organisations to be vigilant of personnel selection, assessment of knowledge ability and experience, and development of skills and expertise. These efforts should be supported by appropriate motivation and conducive environments to realise human potential and achieve higher output. In the construction sector, the selection of suitable personnel for each role, combined with systematic training, performance management, and engagement, is considered a primary mechanism for enhancing both individual productivity and project performance.

Previous research on construction productivity has examined human factors such as team relationships, supervisor-worker communication, role clarity, and site-level working conditions, demonstrating that such factors can serve as both enablers and constraints to productivity [16]. Studies addressing the well-being and psychological state of construction workers have identified income levels, job stability, safety conditions, working time arrangements, and stress as significant variables influencing both efficiency and accident risk [12]. These findings highlight the importance of integrating human factors into project planning and management [17].

In Thailand, research on construction productivity has increased. However, most studies have focused on industry structure, project management systems, and technological advancements, with limited analytical attention to human factors at the site labour level. Furthermore, the Thai construction labour market is characterised by migrant workers, segmented wage structures, inconsistent safety enforcement and cultural management and communication practices. These factors may influence the manifestation and interaction of human factors with project performance in ways that differ from other national contexts. Therefore, it is necessary to identify human-related factors influencing productivity in the Thai construction industry and to prioritize these factors based on Relative Importance Index (RII). The findings are intended to provide a foundation for the development of human resource management strategies and productivity enhancement in the Thai construction context in the future.

2. RESEARCH SIGNIFICANCE

This study is essential because labour productivity in Thailand remains low and continues to persist, creating significant challenges. It addresses a significant gap in existing research, which has mainly focused on technology and management systems, by emphasizing human factors at the operational level. By highlighting the real issues faced on construction sites, the findings provide project managers and construction organisations with a better understanding of workforce problems. The insight gained by this research could be used to develop appropriate human resource management strategies and design productivity improvement in the context of the Thai construction industry.

3. LITERATURE REVIEW

Productivity could defined as the relationship between output and inputs [18]. Construction productivity can normally be understood as work quantity divided by the number of man-hours (or work-hours) consumed to accomplish the work [19]. Jugdev [20] found that productivity is a ratio between inputs and outputs and derives the value of inputs and outputs in terms of labour, materials, equipment, tools, capital, and design in the construction system.

Previous research into construction productivity investigated the factors influencing construction productivity. It has been found that productivity problems are related to human factors, which were ranked 1st among all issues that could affect the quality control of high-rise building construction in Bangkok [21], ranked 2nd among factors related to delays that affect construction labour productivity in Kuwait [22] and ranked 5th among factors influencing productivity in industry in the Kingdom of Saudi Arabia [23].

In the Palestinian industry, lack of experience is the number one problem in manpower that causes low productivity [24]. In addition, previous studies have identified factors affecting productivity in construction in many developing countries, including coordination problems, management, motivation, non-payment, and job site conditions [25-27].

Incentive programs are most commonly used to help motivate workers to increase productivity in construction projects. If an organization lacks incentive programs, such as low wages, late payment, no training sessions, welfare, and labor recognition, this will affect productivity in the developed world, and also in countries in the developing world [24, 28-30].

In addition, a lack of skills and experience can cause miscommunication, while unclear instructions can also affect projects in terms of delays and low productivity [26,31,32].

The human factors identified in this study were obtained from the previous research as show in Table 1. A total 32 factors were applied to the questionnaire.

Table 1. Previous research factors

Author	Factors
Enshassi [24]	Labour dissatisfaction, Misunderstanding among labour, Lack of periodic meeting with labour, Lack of financial motivation system, Lack of places for eating and relaxation, Lack of training sessions
Kadir [26]	Stop work order because of site accident, Change order, Capability of contractor's site management to organize site activities, Coordination problems, Slow local authorities approval, Reluctance of consultant's site staff to work extra days on Sunday and public holiday
Manoharan [27]	Lack of working experience, Lack of knowledge in construction works, Lack of thinking abilities, Physical ability and fatigue, Work overload, Improper material handling, Work dissatisfaction
Kaming [33]	Lack of experience of local regulation, Pool labour productivity, Inadequate planning, Design changes
Mahamid [35]	Lack of labour experience, Bad relations between labors and management team, Rework, Labor's low wage, Lack of supervisor experience, Unsuitable materials storage location, Overmanning, Working within a confined space
Dinh [38]	Number of working hours, Occupational accidents, Break time, Preparing and finalizing time, laws on construction, Training and improving skills, Training on labor safety, Experiences of workers, Ability to organize production
Kazaz [39]	Quality of site management, Systematic flow of work, Crew size and efficiency, On-time payments, Incentive payments and financial rewards
Nyoni [40]	Management, Availability of experienced labour, Education and training manpower, Health and safety environmental, Supervisory incompetence management, Decentralization and delegation management, Personal problems
Makulsawatudom [41]	Incompetent supervisors, Poor communication, Poor site conditions, Poor site layout, Scheduled working overtime, Safety (accidents), Shift work

4. METHODOLOGY

4.1 Questionnaire Survey

This study collected the data using a closed-ended questionnaire. The questionnaire was tested for the item objective congruence (IOC) by five experts from the construction field. The IOC results exceeded 0.5

and the Cronbach's alpha equal to 0.928 which above 0.7 signifies. Therefore, the questionnaire demonstrates high levels of validity and reliability.

The questionnaire comprised two parts. The first part provided general respondents' information. The second part covered 32 human factors affecting construction productivity, with respondents rating the level of impact of each factor on a scale of 1 to 5. These factors were gathered through the literature review. The respondents were all licensed engineers who involved the construction industry in Thailand. The sampling size was determined using the Yamane formula [42]. For a population of 190,019 licensed engineers from the Council of Engineers [43], with an accepted margin of error of 10 percent, resulted in the calculation of the sample size of 100. The questionnaires were emailed to the HR department of construction companies in Thailand, and the total number of respondents was 104.

4.2 Data Collection and Analysis

The data collected from the questionnaire survey were analyzed and ranked using the relative importance index (RII). The RII is calculated by multiplying the score assigned to each factor and the number of respondents divided by the total number of respondents, as shown in equation (1) below [26].

$$\mathbf{RII} = \frac{\mathbf{5(n5)+4(n4)+3(n3)+2(n2)+n1}}{\mathbf{5(n5+n4+3n+n2+n1)}} \quad (1)$$

Where n1, n2, n3, n4, and n5 are the respondents who rated the level of agreement, 1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree and 5 strongly agree.

4.3 Interview Survey

This was a preliminary survey regarding productivity in a construction project conducted through a site visit. This initial interview survey relied on the three-storey building construction project. Data were gathered through interviews with supervisors, comprising two site engineers and two foremen. The data collection period included bricklaying work using lightweight concrete blocks. Data on labour productivity in bricklaying was acquired from the project, and the factors affecting labour productivity in bricklaying activities was examined during the interviews.

5. RESULT

5.1 The Demographic Profiles of the Respondents

The total number of respondents is 104. Table 2-7 shows the general information, including gender, years of working experience, construction type, and main job responsibility.

Table 2. Respondent's gender

Gender	Number	Percent
Female	64	61.54
Male	40	38.46
Total	104	100

For respondents' gender, 38.46 percent were males, and 61.54 percent were females.

Table 3. Respondent's age

Age	Number	Percent
Less than 30 years	58	55.77
30 - 34 year	22	21.15
35 - 40 year	19	18.27
41 - 50 year	2	1.92
51 - 60 year	3	2.88
More than 60 years	0	0
Total	104	100

A percentage of 55.77 of the respondents were fewer than 30 years old, and 21.15 percent were 30-34 years old.

Table 4. Respondent's educational level

Education Level	Number	Percent
High Vocational Certificate	2	1.92
Bachelor's Degree	87	83.65
Master's Degree	13	12.5
Doctor's Degree	2	1.92
Total	104	100

For respondent's educational level, 83.65 percent graduated with a bachelor's degree, and 12.5 percent graduated with a master's degree.

Table 5. Respondent's year of working experience

Year of working experience	Number	Percent
Less than 5 years	62	59.62
5 - 10 year	20	19.23
11 - 15 year	17	16.35
16 - 20 year	1	0.96
More than 20 years	4	3.85
Total	104	100

Regarding years of working experience, 59.62 of the respondents had fewer than five years of working experience, and 19.23 percent had 5-10 years of working experience.

Table 6. Respondent's construction type

Construction type	Number	Percent
Building	50	48.08
Residential	25	25.00
Industrial	15	14.42
Civil	10	9.62
Other	3	2.88
Total	104	100

Most respondents worked in building construction, amounting to 48.08 percent, while 25 percent worked in residential construction and the remaining worked in civil, industrial, and other construction types.

Table 7. Respondent's main job responsibility

Main job responsibility	Number	Percent
Mostly work on-site	32	30.77
Mostly work in the office	36	34.62
Mostly communicate and coordinate	36	34.62
Total	104	100

The respondents' main job responsibilities were working in the office and communicating and coordinating, which were equal to 34.62 percent, along with 30.77 percent who mostly worked on site.

5.2 Human Factors Affecting Construction Productivity

The data collected from the questionnaire survey were analyzed and ranked using the relative importance index (RII). A total of 32 human factors were ranked as shown in Table 8.

Table 8. Ranking the Human Factors Affecting Construction Productivity

Human factors	RII
Adequate amount of personnel safety equipment	0.890
Salaries on time	0.883
Short interval planning and progress tracking in the construction site	0.875
Recruitment and segmentation of worker skills	0.869
Problem-solving skills	0.869
Crew size selecting and assigning the proper work to members	0.865
Reasonably salary	0.863
Equity in salary advancement	0.863
Construction work and engineering knowledge	0.863
Planning and monitoring skills	0.863
Assigning the proper work to employees	0.858
Proper working days and holiday	0.852
Planning site layout and transport route skills	0.852
Competence to manage the change order	0.850
Safety programs to prevent the accidents	0.846
Fair treatment in the workplace	0.846
Leadership skills	0.846
Communication and coordination skills	0.846
Provide adequate training to the worker	0.842
Overtime payment	0.842
Recreation area	0.842
Worker recognition program	0.838
Material storage	0.837
Site layout management	0.837
Law and contract law knowledge	0.837
Reduce number of reworks	0.833
Decentralize decision-making to site staff	0.831
Positive employee attitude	0.831
Site restricted access	0.827
Local authority coordinator	0.825
Reducing site congestion	0.823
Financial incentive	0.819

The top five factors affecting construction productivity are adequate personnel safety equipment, salaries on time, short-interval planning and progress tracking in construction sites, recruitment and segmentation of worker skills, and problem-solving skills.

5.2.1 Adequate amount of personnel safety equipment; RII equal to 0.890

Safety is the top priority issue in construction projects because it causes injury or worse. It was ranked second among employee productivity problems in India [45] and sixth in the UAE [25]. Construction worksites are dangerous areas and full of risks. OSHA has defined the Four job site hazards in construction projects: falls, caught-in or between, struck-by, and electrocution. Therefore, the workers should have enough safety equipment, such as a hard hat, foot protection, face and eye protection, and high-visibility clothing during work. The safety equipment will ensure the worker can work in safe conditions and lessen the chance of an accident.

5.2.2 Salaries on time; RII equal to 0.883

It was ranked third among labour productivity problems in many countries, such as the UAE [25], KSA [31], and Turkey [39]. The employee would measure the company's reliability by the financial condition because it is related to their well-being and the work-life balance which results in productivity. Employees perceive the on-time payment as the most important motivator. Sometimes, it could be used to drive the work and increase productivity and progress

in construction projects.

5.2.3 Short interval planning and progress tracking in the construction site; RII equal to 0.875

Most construction projects have difficulty with delay problems that will affect time, cost, and quality. This problem was ranked first among other labor productivity problems in Pakistan [44] and ranked third in India [45]. The project's baseline schedule will determine the relation of each construction activity and the overall time duration. However, it is still turbulent and lacks precision. Thus, the schedule in short intervals will ensure the precise time and careful planning and preparation of what is required in work, such as crew size, construction material, and all equipment. This strategy can improve schedule management and improve productivity in construction projects.

5.2.4 Recruitment and segmentation of worker skills; RII equal to 0.869

This problem was ranked as the most crucial problem in KSA [31]. Managing a diverse workforce in a construction organization, where employees come from various backgrounds in terms of skills, roles, nationality, demographics, and performance levels, presents both challenges and opportunities. Therefore, recruitment and implementing a workforce segmentation strategy can effectively develop a working team and be associated with managing multiple human resources management that retain a diverse workforce, fostering innovation, creativity, and productivity within their teams.

5.2.5 Problem-solving skills; RII equal to 0.869

Problem-solving skill was ranked third among productivity problems in Pakistan [44] and ranked fifth in Turkey [39]. Possessing problem-solving skills is a key characteristic of successful project managers. Solving problems and decision-making is a regular activity in the construction business, but this skill is honed via experience and relentless application. It is beneficial to have a person who can identify, judge, and act quickly when difficulties arise in a construction project because it will lessen the uncertainty, reduce the chance of delay, and raise productivity.

5.3 Labor Productivity in the Bricklaying Work

The preliminary survey related to productivity in construction involved a site visit to a three-storey building project and interviews with four relevant supervisors. During the data collection period, the work was focused on bricklaying work using lightweight concrete blocks. The project employed a total of 8 bricklayers. The average labour productivity of the bricklayers in this project was 1.2 square metres per person per hour, compared to the statistics average labour productivity of bricklayers in Thailand, which is approximately 3.5-4.5 square metres per person per hour [46]. The average labour productivity of the bricklayers in this project is lower than the standard average labour productivity of bricklayers. The causes identified are as follows:

1. The bricklayers lack the necessary skills for bricklaying. Among the workers assigned to the bricklaying tasks, only three are skilled bricklayers, while the remaining six lack any bricklaying experience. The project supervisor transferred workers from other departments to assist with the bricklaying tasks in line with the project schedule. The project initially required additional bricklayers, but the HR department was unable to identify suitable candidates. Consequently, the decision was made to reassign workers from the structural work section to help with the bricklaying tasks. As a result, labour productivity in bricklaying is low, and the quality and efficiency of the work are substandard.

2. There was a lack of supervision during the work, which led to disorganised and inconsistent practices that did not adhere to standard procedures. Workers operated independently, which resulted in mistakes, such as skipping or misordering steps in the process. Furthermore, the quality control measures were inadequate. Issues such as misaligned walls, improper mortar mixing for bricklaying, and insufficient mortar application led to subpar work quality. These problems necessitated continuous rework, resulting in increased time and costs for the project. As a result, labour productivity in bricklaying declined.

3. There was insufficient work planning, exemplified by the unavailability of tools and materials necessary for bricklaying. The essential materials for daily tasks, such as bricks and mortar, were frequently in short supply, resulting in workers experiencing idle time as they awaited the arrival of tools and materials. This extended waiting period led to inefficiency in the management of workers' time, ultimately contributing to reduced productivity.

4. There was a lack of appropriate tools for the work, such as trowels for plastering lightweight concrete blocks and brick-cutting machines. The selection and provision of suitable tools for the job would help improve accuracy and precision, enhance convenience, and increase work speed. This, in turn, would lead to an increase in labour productivity.

5. There was no clear definition of the daily work quantity to be completed. Without specific daily targets or work milestones, measuring progress, ensuring consistent productivity, and maintaining focus on the required work volume become challenging. This lack of planning leads to inefficiencies and delays in the project timeline.

The issues identified in the bricklayers' on-site work align with the findings from the survey data, according to the information provided.

6. CONCLUSION

This study aims to identify factors affecting labor productivity in construction projects in Thailand, utilizing a questionnaire for data collection. Through the analysis of RII values, the five factors with the greatest impact on productivity are determined. The five most important factors are:

1. Adequate amount of personnel safety equipment; RII equal to 0.890
2. Salaries on time; RII equal to 0.883
3. Short interval planning and progress tracking in the construction site; RII equal to 0.875
4. Recruitment and segmentation of worker skills; RII equal to 0.869
5. Problem-solving skills; RII equal to 0.869

The labour productivity survey conducted on the bricklaying work for the three-storey building construction project indicated that the productivity of bricklayers involved in this project is 1.2 square metres per person per hour. This figure is significantly lower than the statistics average productivity for bricklayers in Thailand, which stands at 3.5-4.5 square metres per person per hour square metres per person per hour [46]. The challenges faced by the bricklayers include a shortage of skilled labour, insufficient supervision resulting in compromised work quality, a lack of effective work planning, and inadequate tools.

A previous study from the 1990s and this study still present the same significant factors affecting labour productivity. Factors include issues related to poor communication, poor site conditions, poor site layout, interference from crew members, scheduled working overtime, and safety. These factors represent organizational management and planning problems. Therefore, Thailand has continuously been inadequate in improving productivity from the past to the present, and the construction industry in Thailand remains unaware of the crucial role of human resources, which have been determined to drive project activities to achieve maximum productivity. Moreover, respondents suggested that an engineer's experience and working abilities are also essential elements for success in the workplace because having a thorough understanding of the required knowledge, such as constructability and structural engineering, codes of practice in construction, the selection of construction equipment, quality requirements of materials and material testing, and reducing defects and errors in construction projects will help engineers to perform better and increase productivity in their work.

Meanwhile, organizations should implement suitable strategies for HR management and select suitable individuals for jobs. They are also responsible for supporting activities within construction operations and providing sufficient incentive and engagement programmes for HR sustainability.

This study forms the initial investigation of human factors affecting the productivity of Thai construction projects by using the questionnaire survey and interviews. Therefore, future research should focus on identifying specific human factors that can enhance work performance at both the supervisory and worker levels. These factors may include selection criteria, employment methods, motivation strategies, and resource management approaches. Additionally, even though highly skilled and experienced workers may have high productivity, it is important to consider that labour costs tend to be higher.

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