Mathematical Statistician and Engineering Applications
ISSN: 2094-0343
2326-9865

Engineering Project Communications Management Challenges in Construction Industry during COVID-19 Pandemic: An Analysis via IBM SPSS Statistics 28.0

[1] Chitdrakantan Subramaniam, [2] Syuhaida Ismail, [3] Wan Nurul Mardiah Wan Mohd Rani, [4] Felix Kin Peng Hui

[1] Universiti Teknologi Malaysia, [2] Universiti Teknologi Malaysia, [3] Universiti Teknologi Malaysia, [4] The University of Melbourne
[1] chitdrakantan@graduate.utm.my,[2] syuhaida.kl@utm.my, [3] wnurul.kl@utm.my, [4] kin.hui@unimelb.edu.au]

Article Info
Page Number: 6525-6542
Publication Issue:
Vol. 71 No. 4 (2022)

Article History
Article Received: 25 March 2022
Revised: 30 April 2022
Accepted: 15 June 2022

Abstract
During the Coronavirus Disease 2019 (COVID-19) outbreak, the workers at construction sites that involved various engineering works at a time were reduced up to 50 percent while various restrictions, namely social distancing, were in place as a preventative measure from possible COVID-19 transmission, thus miscommunication amongst the workers is expected, leading to delay, cost overrun and marred quality. Therefore, this paper aims to assess the challenges of engineering project communications management at construction sites involving the engineering works during the COVID-19 outbreak in Malaysia based on the eleven channels of communication. Through the systematic literature review (SLR), a questionnaire was developed and tested via a pilot study before it is distributed at four construction sites of mixed development projects with a total of 392 respondents. Through the relative importance index analysis undertaken via the IBM SPSS Statistics 28.0, this paper found that formal communication is the most critical channel due to the delay in formal information flow from the upper management, followed by the informal communication and project reports due to the inability to decipher the informal information based on site conditions and lack of details in the project reports, respectively. This paper concludes that the engineering project communications management in the construction site during the COVID-19 outbreak in Malaysia faces many challenges, yet these are still manageable.

Keywords: Engineering project communications management, challenges, Malaysia, construction industry, COVID-19, IBM SPSS Statistics 28.0

I. INTRODUCTION

The Malaysian construction industry market size was of USD27 billion in 2021 and is expected to achieve the average annual growth rate (AAGR) of more than 6% during 2023-2026 [1]. It is therefore seen as the economic driver for the nations as it drives job growth and improves productivity [2] due to the vulnerabilities in the real estate segment, higher levels of non-sold

residential properties and over-supply of commercial properties [3]. In particular, civil engineering is the main driving force for development in the construction sector, driven by the continuing advances in major petrochemical, transportation and infrastructure ventures.

The construction industry is undoubtedly one of the key catalysts that contribute dynamically to the Malaysian economy by implementing government-initiated mega infrastructure projects and private sector commercial ventures. Realising the importance of ensuring the projects are not hampered by poor performance, the Ministry of Works implemented the National Construction Policy 2030 (NCP 2030) in 2021 [4].

The NCP 2030 is a joint national effort to ensure the Malaysian construction industry's sustained growth and success. It has initiated a wide range of programmes, policies and events since its establishment. It seeks to transform the construction industry by accelerating the technology adoption in all work processes including before, during and after construction [5]. Generally, the NCP 2030 is instrumental in garnering industry stakeholders' commitments were crucial to ensure its goals were met despite the outbreak of Coronavirus Disease 2019 (COVID-19) that has certainly crippled the world economy. This COVID-19 pandemic outbreak's challenging, unpredictable scenarios, economic consequences and catastrophic social, which is also known as a black swan event that caused "unknown unknown" [6] has a significant effect on construction projects, both physically and contractually. The stop-work order has caused severe delay, in fact, the supply chain of construction material and man-power supply have been badly disrupted.

On the other hand, the construction industry has a direct impact since it is well known as the multidisciplinary industry, involves many stakeholders, and requires a significant number of the workforce [7]. Due to the restrictions of movement control order (MCO), conditional movement control order (CMCO) and the initial standard operating procedure (SOP), the number of workers at the construction site is encouraged to be reduced up to 50 percent to lessen the possibility of COVID-19 infection [8]-[10]. Undoubtedly, this restriction has halted all construction activities in Malaysia. Active participation of multi-level construction stakeholders under numerous constraints as a result of the government's mitigation and recovery strategy during MCO has resulted in the emergence of COVID-19 new clusters at construction sites thus lead to inadequate and ineffective engineering project communications management practices among stakeholders. It is apparent that the construction industry is expandable and complex in nature involving diverse engineering activities, added with the presence of COVID-19 has led to intensified challenges and difficulties in delivering efficient, sustainable and reasonable quality products. Hence, ensuring the project's success is undoubtedly an uphill battle, especially to the project managers.

The construction industry requires a huge number of workforces and good communication between them due to its complexity. With the reduced number of workers at construction sites, the communication between them becomes more challenging. Therefore, this paper aims to assess the challenges of engineering project communications management at construction sites during the COVID-19 outbreak in Malaysia.

II. LITERATURE REVIEW

A. Engineering Project Communications Management

Generally, communication is the transfer of knowledge to establish a common understanding. Communication can be defined as the process of data transmission and mutual understanding between one person or group and another. This is done by exchanging ideas, images or details such as speech, pictures, symbols, written materials or actions [11]. "Communication" is originated from the Latin word "communis," carrying the meaning of "common". Therefore, "to communicate" basically means "to make common" or "to make known", "to share" and includes verbal, non-verbal and electronic means of human interaction [12] Therefore, communication is defined as knowledge exchange that can be done either written or oral.

Engineering project communications management is often viewed as a strategic organisational feature for tangible information conveyed between the sender and the recipient [13] in projects involving diverse engineering activities. Generally, engineering project communications management consists of two sections. Firstly, establish a plan to ensure successful coordination with stakeholders and followed by implementing the tasks needed to execute the communication plan [14] while undertaking the engineering activities. The Project Management Body of Knowledge (PMBOK) highlighted that 90 percent of a project manager's time is spent in communication among those involved in a project [14]. This clearly demonstrates the major role played by engineering project communications management. Thus, it further validates the need to understand engineering project communications management's fundamentals to ensure the successful completion of a project.

B. Challenges of Engineering Project Communications Management

The current COVID-19 pandemic has undeniably slowed down the activities at construction sites. In fact, when the MCO was imposed, construction sites were not allowed to operate, causing a total shutdown. The initial SOP implemented by the Ministry of Health Malaysia (MOH) only allowed half of the workforce to be present at the site and social distancing is maintained at all time, which includes significant reduction of face to face discussions, group meetings and crowding at common areas [9].

That aside, construction projects are already known to be complex and involve various stakeholders that often lead to miscommunication [15]-[17]. This is mainly caused by the subcontracting system that has been traditionally practised in the construction industry [18]. The more intricate the construction project is, the more misunderstandings will occur. The complexity of construction projects can be classified into two major categories, which are technical complexity and operational complexity. Obviously, today's construction projects are more technologically advanced. As a consequence, more information must be communicated at any moment among a wider number of individuals [19].

Similarly, the consequences of diverse stakeholders in the construction industry often lead to

distorted, vague, and delayed information exchange [20]-[21]. It also influences one's motivation to communicate with the team hence influences decision making. Furthermore, engineering project communications management is much more critical due to its decentralised work nature because numerous stakeholders are involved and participate at different project phases [22] involving diverse engineering activities.

However, poor communication is one of the main causes of project failure regardless of the project scale and complexity [15]. In the context of improving construction project performance, the importance of engineering project communications management in the construction industry is essential [23]. It is evident that achieving successful communication among stakeholders itself is a major challenge. Hence, implementation of MCO and COVID-19 related SOPs is expected to oppress engineering project communications management's existing challenges.

Based on a study on challenges to effective communication in Nigeria's construction industry, reporting progress, leadership, attitude, multi-cultural environment and defined clear communication channel has been identified as crucial elements to implement effective communications management [23]. An unclear communication channel causes distorted information flow due to inexperience and employees' personal attitude [24]. Apart from that, late dissemination of information also contributes towards poor performance.

Based on a case study on the Dubai-Fujairah Highway project, it is found that two main engineering project communication challenges are inexperienced management staff and limited knowledge sharing amongst project workers [25] especially involving highly technical engineering activities. Additionally, out of 19 different reasons of communication failure, technical jargon, language difference, refined information and self-interest were identified as the most prevalent impediments to effective engineering project communications management [26].

In Malaysia, it is reported that there are nearly 1.99 million foreign workers registered till August 2019, out of which 429,552 foreign workers are registered under the construction industry [27]. This figure certainly reflects on the magnitude of multi-culture as well as numerous native languages used by the workers. As a result, multi-cultural and diverse native languages will threaten effective communication in construction projects. It will be a challenge for the management to maintain successful communication between the different cultural groups [28].

It suggested that language barrier is a form of communication obstacle between the supervisors and foreign workers [29]. This situation has alarmed stakeholders in the Malaysian construction industry. Furthermore, the study also highlighted that the language barrier has often led to delays and breach of safety regulation. The evidence suggests that the language barrier can lead to misunderstanding, messages misinterpretation, distorted messages, misinformation, poor management and wrong feedback among the team [30]

Likewise, it is found that lack of a common language between supervisors and foreign workers is one of the main causes of poor communication in the Malaysian construction industry [31]. As a result, workers' diverse nationality in the Malaysian construction industry must not be taken lightly as evidence shows that different languages and multi-culture certainly pose a serious threat to a project's performance. Table 1 compiles the most common engineering project communication challenges that impact project performance. The construction industry being complex and dynamic, inexorably falls under the threat of miscommunication. It is even more vulnerable since there are various stakeholders within a single project. With the involvement of several parties, information is often distorted and is circulated late. Distorted and late information inevitably will impact the success of a project. Moreover, messages are generally conveyed through unclear communication channels and results in misconception.

Additionally, the language barrier and multi-culture amongst foreign workers influence communication effectiveness negatively. Besides, lack of technical knowledge among the foreign workers added with individual personality factor further impacts the project performance. Although it is common to use technical jargons during site progress and toolbox meetings, it is typically misconceived by the foreign workers mainly due to lack of technical knowledge.

Subsequently, COVID-19 and the implementation of standard operating procedures (SOPs) at construction sites in Malaysia further heighten the impact of identified communication challenges. Therefore, it is essential to place adequate importance on the engineering project communication challenges, thus increasing the possibility of completing a project successfully. This paper focuses on the unclear communication channel as it is one of the main communication challenges as illustrated in Table 1 [15], [18], [20], [22]-[24] that can be divided into eleven, namely: (1) site review meeting; (2) team meeting discussion; (3) project reports; (4) formal communication; (5) informal communication; (6) work breakdown structure; (7) organisational breakdown structure; (8) record management system; (9) technology; (10) employee suggestion scheme; (11) resource breakdown structure [18], [15], [22], [24], [31]-[32], [33]-[34]. These channels can be measured by the six communication efficacy criteria, which are: (1) specificity; (2) processes; (3) barriers; (4) clarity; (5) timeliness; and (6) completeness [15], [20]-[21], [29], [35]-[38].

Table 1. Main challenges of engineering project communications management

Olaniran (2015)	Communication Challenges	[15]	[16]	[18]	[20]	[22]	[23]	[24]	[26]	[29]	[30]	Frequency
1	Unclear communication channel	x		x	x	x	x	x				6
2	Distorted information	x		x	x	x	x	x		x	x	6

3	Late information dissemination			x	x	x	x	x		x		6
4	Multiple stakeholders	x	x	x	x		x	x				6
5	Language barrier	x				x	x	x		x	x	6
6	Usage of technical jargon		x		x	x	x		x		x	6
7	Lack of necessary skills		x		x			x	x			5
8	Multi-cultural work environment						x	x	x	x	x	5
9	Personality factor	x	x					x	x	x		5

Source: [15]-[16], [18], [20], [22]-[24], [26], [29]-[30]

III. METHODOLOGY

This paper consists of secondary and primary data collection. The secondary data is collected through a systematic literature review (SLR), focusing on eleven channels of communication and six efficacy criteria. The primary data of this paper is the questionnaire survey that was developed based on secondary data. The designed questionnaire was later tested via a pilot study for the reliability [39] prior to the actual data collection with a Cronbach's alpha value of 0.9983. The data collected were analysed using the relative importance index via the IBM SPSS Statistics 28.0 to rank the criticality of each challenge. Based on Table 2, communication challenges were shortlisted and ranked by considering challenges with equal or more than 60 percent only. Engineering project communication challenges equal to or more than 60 percent are either considered as high-medium critical (H-M-C) or high critical (H-C).

Table 2. Level of challenges based on Relative Importance Index (RII) range

RII Range	Description
$80 \leq RII \leq 100$	High critical (H-C)
$60 \leq RII < 80$	High-medium critical (H–M-C)
$40 \leq RII < 60$	Medium critical (M-C)
$20 \leq RII < 40$	Medium-low critical (M-L-C)
$0 \leq RII \leq 20$	Low critical (L-C)

Source: [40]-[41]

IV. RESULTS AND DISCUSSION

The paper had undergone a pilot study for the reliability test, with 39 samples equivalents to 10 percent from the expected population of 384 respondents following the suggestion by [42]. The designed questionnaire is considered reliable based on the pilot study, with a Cronbach's alpha value of 0.9983. The tested questionnaires were printed and distributed at four construction sites involved with mixed development projects. A total of 392 respondents completed the questionnaires, where 89 percent of respondents were male, whereas the rest were female. A total of 184 respondents were of Indonesia nationality, followed by 96 respondents of Pakistan nationality and 84 respondents of Bangladesh nationality. Out of which 48 percent of respondents only attended primary school, 41 percent attended secondary school, 6 percent received a certificate, 1 percent completed diploma and 4 percent obtained a degree. At 66 percent, the majority of the respondents have less than five years of working experience, followed by 27 percent with working experience between five to ten years. From this amount, 63 percent of respondents have been involved in only three and fewer mixed development projects.

The data collected were analysed using the Relative Importance Index (RII) via the IBM SPSS Statistics 28.0 to rank the criticality of each challenge. Based on Table 2, only two channels are considered high-medium critical (H-M-C), which are formal communication and informal communication. Under formal communication, four challenges are considered as H-M-C, namely: (1) delay in formal information flow from the upper management (timeliness); (2) formal instructions are complicating (processes); (3) lack of details in the formal information (completeness); and unable to decipher the formal instructions based on site condition (specificity). These challenges prove that reduction of workforce at construction site due to movement control order (MCO) and conditional movement control order (CMCO) as well as limited face to face discussions as required by the standard operating procedures (SOP) negatively impact the timeliness as a result of longer duration taken for information transfer in formal communication, causing the formal communication process to be more complicated. Hence, it reduces completeness due to the loss of important information and decreases the specificity or accuracy of formal communication information.

The second H-M-C channel of communication due to physical communication restriction and reduction in the number of workforces at site is informal communication. Unfortunately, the challenges were identified as H-M-C under this channel, namely: (1) unable to decipher the informal communication based on site condition (specificity); (2) delay in informal communication flow from the upper management (timeliness); and (3) limited access to informal communication related documents (barriers). Similar to formal communication, the MCO, CMCO and SOP have explicitly impacted informal communication. It has reduced the specificity or accuracy of informal communication and timeliness due to the increase in time taken for information transfer due to the constraints faced at construction sites caused by COVID-19 outbreak. Additionally, the reduction of workforce and refrained face to face meetings at construction sites have imposed limitations in accessing information through

informal communication.

Although the project report is not one of the H-M-C identified channels, three of its engineering project communication challenges falls under it. The H-M-C identified communication channels are: (1) lack of details in the project reports (completeness); (2) limited access to the project reports related documents (barriers); and (3) delay in project reports related information flow from the upper management (timeliness). This paper observed that the reduction of workforce at construction sites and limited physical contact reduces the completeness, resulting in loss of important information compiled in the project reports. Apart from that, the restrictions in place due to the COVID-19 outbreak, increase difficulties in accessing the project reports and incur delay in distributing the report to the workers.

Despite none of these channels, site review meetings and employee suggestion schemes are specifically identified as H-M-C challenges of engineering project communications management at construction sites due to workforce reduction and limited physical contact. Both channels have each one H-M-C challenge identified. Under the site review meeting, low language proficiency negatively impacts site review meeting (barriers) and is identified as H-M-C challenge. This might be due to the inability to comprehend the details discussed during the site review meetings since the majority of the workers were either primary or secondary school educated. On top of it, 66 percent of the workers have only less than five years of working experience. For the employee suggestion scheme communication channel, the identified H-M-C is limited access to submit through the employee suggestion scheme (barriers), which could be due to the constricted number of construction workers allowed to bring forward complaints or proposals via the employee suggestion scheme.

Table 3. Challenges of engineering project communications management by channel

Challenges	RII	RII Ranking	Ave RII	Ave RII Ranking
Formal Communication				
Delay in formal information flow from the upper management.	66.07	1	62.33	1
Formal instructions are complicating.	65.15	2		
Lack of details in the formal information.	62.35	3		
Unable to decipher the formal instructions based on site condition.	62.35	3		
Unable to understand the technical details in the formal instruction	59.90	5		

related documents.				
Limited access to formal instruction related documents.	58.16	6		
Informal Communication				
Unable to decipher the informal communication based on site condition.	62.76	1	60.55	2
Delay in informal communication flow from the upper management.	60.87	2		
Limited access to informal communication related documents.	60.82	3		
Unable to understand the technical details in informal communication.	59.80	4		
Informal communications are complicating.	59.59	5		
Lack of details in the informal communication.	59.49	6		
Project Reports				
Lack of details in the project reports.	60.66	1	59.74	3
Limited access to the project reports related documents.	60.46	2		
Delay in project reports related information flow from the upper management.	60.46	2		
Project reports are complicating.	59.64	4		
Unable to decipher the project reports based on	58.88	5		

site condition.				
Unable to understand the technical details in the project reports.	58.32	6		
Team Meeting Discussion				
Lack of details discussed in the team meeting discussion.	59.39	1	58.21	4
Low level of language proficiency negatively impacts team meeting discussion.	59.23	2		
Lack of regular team meeting discussions.	58.57	3		
Unable to understand the technical details in the team meeting discussion.	57.96	4		
Workers are not well represented in the team meeting discussion thus do not understand the actual site situation.	57.09	5		
Procedures related to the team meeting discussion are complicating.	56.99	6		
Site Review Meeting				
Low level of language proficiency negatively impacts site review meeting.	60.82	1	58.02	5
Unable to understand the technical details in the site review meeting.	59.85	2		
Lack of details discussed in the site review meeting.	58.47	3		
Workers are not well represented in the site review meeting thus do	56.53	4		

not understand the actual site situation.				
Procedures related to the site review meeting are complicating.	56.28	5		
Lack of regular site review meetings.	56.17	6		
Employee Suggestion Scheme				
Limited access to submit through the employee suggestion scheme.	61.73	1	57.95	6
Lack of details required by the employee suggestion scheme.	58.72	2		
Unable to understand the details required by the employee suggestion scheme.	58.21	3		
Delay in executing the employee suggestion scheme by the upper management.	58.11	4		
Procedures to submit suggestions through the employee suggestion scheme are complicating.	55.87	5		
Unable to explicitly express through the employee suggestion scheme.	55.05	6		
Organisation Breakdown Structure				
Delay in organisation breakdown structure related information flow from the upper management.	58.88	1	57.38	7
Limited access to the organisation breakdown structure related	57.96	2		

documents.				
Unable to decipher the organisation breakdown structure based on site condition.	57.30	3		
Procedures in organisation breakdown structure are complicating.	57.30	3		
Lack of details in the organisation breakdown structure.	56.79	5		
Unable to understand the technical details.	56.07	6		
Record Management System				
Unable to optimise the record management system based on site condition.	57.96	1	57.36	8
Lack of details in the record management system.	57.96	1		
Unable to understand the technical details.	57.91	3		
Delay in record management system related information flow from the upper management.	56.94	4		
Procedures in record management system are complicating.	56.84	5		
Limited access to the record management system.	56.53	6		
Resource Breakdown Structure				
Unable to decipher the resource breakdown structure based on site condition.	58.11	1	57.07	9
Delay in resource	57.60	2		

breakdown structure related information flow from the upper management.				
Lack of details in the resource breakdown structure.	56.99	3		
Limited access to the resource breakdown structure related documents.	56.89	4		
Procedures in resource breakdown structure are complicating.	56.43	5		
Unable to understand the technical details.	56.38	6		
Work Breakdown Structure				
Delay in work breakdown structure related information flow from the upper management.	57.40	1	56.56	10
Lack of details in the work breakdown structure.	56.73	2		
Unable to understand the technical details.	56.48	3		
Limited access to the work breakdown structure related documents.	56.33	4		
Unable to decipher the work breakdown structure based on site condition.	56.22	5		
Procedures in work breakdown structure are complicating.	56.22	5		
Technology				
Delay in information flow from	57.40	1	56.06	11

technology-based communication platform.				
Procedures to access information from technology-based communication platform are complicating.	57.19	2		
Unable to understand the information from technology-based communication platform.	56.12	3		
Limited access to technology-based communication platform.	55.66	4		
Lack of details recorded in the technology-based communication platform.	55.46	5		
Unable to decipher information from technology-based communication platform.	54.54	6		

This paper shows that none of the communication channels and the challenges of the engineering project communications management is identified as high critical (H-C) due to the reduced number of workforces and limited physical presence at the construction site as a result of MCO, CMCO and SOP. Unfortunately, 82 percent of engineering project communications management challenges and 82 percent of the communication channel tested are considered medium-critical (M-C). In contrast, the remaining 18 percent are considered as H-M-C. This paper found that a reduced number of the workforce at the construction site and limited physical presence of workers negatively impact engineering project communications management, especially in terms of specificity, processes, barriers, timeliness and completeness of many communication channels.

The SI unit for magnetic field strength H is A/m. However, if you wish to use units of T, either refer to magnetic flux density B or magnetic field strength symbolized as $\mu_0 H$. Use the center

dot to separate compound units, e.g., "$A \cdot m^2$."

CONCLUSION AND RECOMMENDATION

To sum up, none of the communication channels faces high critical (H-C) challenges of engineering project communications management due to the reduced number of workforces at the construction site and limited physical presence of workers. Unfortunately, 82 percent of the challenges in engineering project communications management and 82 percent of the communication channel tested are considered as medium-critical (M-C). In contrast, the remaining 18 percent are considered as H-M-C. Furthermore, this paper concludes that engineering project communications management in the construction site during the COVID-19 outbreak in Malaysia faces many challenges, yet these are still manageable. The paper faced some imminent limitation, such as stringent health and safety requirements and restricted physical data collection activity due to standard operating procedures (SOPs) in place. Therefore, this paper suggests that future study shall explore other mechanisms of data collection and possible solutions to counter these challenges to ensure the sustainability of the construction industry.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to the Ministry of Higher Education Malaysia (MOHE), Universiti Teknologi Malaysia (UTM) and the Research Management Centre (RMC) of UTM for providing the financial support for this paper to be published. This research is financed by MOHE under Fundamental Research Grant Scheme (FRGS) with Registration Proposal No: FRGS/1/2021/TK01/UTM/02/5. This paper is also one of the products of the 2022 APEC-Australia Women in Research Fellowship funded by the Australian Government, implemented by the Australian APEC Study Centre (AASC) and hosted by the University of Melbourne.

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