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Improving Project Communications Management Practices in the Construction Sector during the COVID-19 Pandemic: A Malaysian Scenario

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Abstract: The construction industry remains an important economic sector that supports the growth of a nation. It is vital to maintain the industry's momentum when facing the Coronavirus Disease 2019 (COVID-19) pandemic, or similar in the future, to ensure employability and decent jobs for every individual in the industry, especially foreign labourers who are always regarded as vulnerable. Improving existing project communications management practices is essential to suppressing infection among labourers; however, there are only a few efforts made to understand the current condition. This study explores the communications management barriers and the potential improvement measures amid the COVID-19 outbreak sweeping across the Malaysian construction industry. The findings disclose that out of eleven communication channels, only six communications management barrier variables with eight items, and three communications management improvement measure variables with seven items, are classified as highly critical, based on a systematic literature review (SLR), and a questionnaire survey on 100 foreign labourers and management team members, respectively, where the data gathered were analysed using the Rasch measurement model. The finding also suggests that site review meetings, team meeting discussions and project reports require immediate attention to ensure the construction industry remains robust without significant interruption during the course of the pandemic.

Keywords: construction project; project communications management; foreign labourers; COVID-19

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1. Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic is causing widespread disruption across the globe and, as a result, a number of countries including Malaysia, have been forced to implement lockdowns in an effort to stop the virus from spreading [1]. The COVID-19 pandemic has infected more than 500 million individuals [2]. It spreads at an incredible rate, causing countries to enforce restrictions on movement to stop the virus from spreading [3]. The Emergency Committee of the World Health Organization (WHO) has declared the ongoing COVID-19 pandemic a global Public Health Emergency of International Concern (PHEIC), which defines a pandemic as an extraordinary event that poses a public health risk to other States due to disease transmission across international borders and may necessitate a coordinated worldwide response [4]. This announcement was made in light of the urgent need for drastic action.

Lockdown imposed on construction projects was imminent since the Ministry of Health, Malaysia, reported that 53.2 percent of COVID-19 clusters emerged from the workplace, where one of the three most important contributors is the construction industry [5]. This trend is expected to continue if drastic measures are not initiated [6]. The action to impose lockdown and the closure of certain business sectors caused the economic growth

around the world to weaken because of unresolved trade tensions, a drop in investment, more volatile markets and geopolitical uncertainty wherein 2019, the global growth rate was only 2.5 percent, down from 3.0 percent in 2018 [7]. The Construction Industry Development Board, Malaysia (CIDB), in its 2019 Annual Report, indicated that the global economy is expected to experience a negative growth at the rate of −3.0 percent, hence the domestic economy is forecasted to contract between −5.5 percent to −3.5 percent in 2020 [7]. This will make it more difficult to achieve the goals of sustained economic growth, complete and productive employment and decent work for all people, as outlined in Sustainable Development Goal 8 of the United Nations, which is Decent Work and Economic Growth (SDG8) [8].

As a consequence of this, the preventative measures that were adopted in the construction industry in order to control the spread of the virus had a considerable influence. Moreover, in the current crisis, declining revenue and rising project delivery issues resulted in poor performance among the industry players, thus negatively impacting the labour force [9]. In Malaysia, a year-on-year comparison clearly shows that the construction industry has contracted as much as 21 percent. In contrast, the quarterly comparison reveals that the value of completed construction work decreased by 12 percent from the previous quarter [10]. The COVID-19 pandemic impacts human life and drags the economy to its worst, involving most major economic contributors [11]. As a result, construction projects had to be put on hold or cancelled because there were insufficient materials and equipment because of the lockdown.

Even though the Malaysian authorities are mulling to evolve from pandemic to endemic (Camoens, 2022) [12] and, although the construction industry is in better shape now than it was in mid-2020, many projects are still on hold, postponed and awaiting approval from local authorities before they can continue work [13]. Furthermore, the COVID-19 standard operating procedure (SOP) by the National Security Council (NSC) imposes the requirements to ensure social distancing, reduction in the workforce and limiting face-to-face interaction, which are strictly enforced [14]. Since 90 percent of time spent on a project is through communication (PMI, 2017) [15], Olanrewaju et al. (2021) [13] added that there is a need to explore the situation and initiate measures that include improvising communications management in the industry that are COVID-safe.

Having said that, it is imperative to ensure that every individual involved in a project has a good grasp of daily activities happening on the site. With so many limitations, the construction industry needs a strong platform and mechanism for communication if it wants to stay on track [16]. Furthermore, Pamidimukkala and Kermanshachi (2021) [17] stressed that good interaction through a profound communications management plan between labourers and supervisors is an important element in preventing the virus from spreading. This is important as foreign workers are vulnerable and easily get infected with COVID-19 due to their accommodation conditions; thus, they may also risk spreading it at site [18]. Furthermore, an observation by the Ministry of Health, Malaysia reflected that transmission of COVID-19 among foreign workers are mostly caused by cramped work sites and crowded living quarters [19]. The International Labour Organization (ILO) reported that foreign workers are the most impacted from the construction site shutdown during the peak of COVID-19 pandemic, as most of them are left jobless and without any alternative income [20]. Many foreign workers flee due to improper medical attention or solution while no new workers could enter the country, causing a shortage of manpower, thus slowing down the industry [21]. Every stakeholder was impacted and realised that a structured communication plan that is capable of withstanding the challenges caused by COVID-19 prevention measures is lacking. Equally important is the factors taken into consideration to develop the project communications management plan, which is crafted based on critical elements of the actual situation at construction sites.

This is only possible by collecting data from respondents from the construction projects that were allowed during the Movement Control Order (MCO). Therefore, this study focuses on identifying the critical communications management barriers during the COVID-

19 pandemic and, thereafter, outlines the significant communications management improvement measures that will help overcome communication breakdown, thus supporting the goal of SDG8. The outcome of the study will be instrumental in the future development of a workable communications management if a similar catastrophe hits the construction industry and other similar industries.

2. Project Communications Management

In any sector, especially in the construction industry, communication is essential to the successful completion of project activities. Project communications management ensures that project information and stakeholder needs are met by carrying out activities [15]. Hence, providing a steady flow of information throughout the project is essential.

In general, communication is described as a mechanism for communicating information between individuals or organisations in order to attain a shared understanding. This is accomplished by exchanging ideas or information, such as words, photographs, gestures, written materials or actions [22]. Theoretically, communication is founded on a Latin word communism, which means to communicate, to make common, and to make known via verbal, nonverbal, a digital platform, or a mix and is therefore considered a sort of knowledge sharing that can take place in writing or verbally via upward, downward or lateral communication [23].

The most common model is linear, which illustrates how a sender sends an information to a receiver through various communication channels, with noise and barriers in the way. Fundamentally, the project communications management plan is developed based on the Shannon–Weaver Communication Model that clearly positions the function of the sender, decoding, channel, noise, encoding and receiver [24,25]. The model also highlights the importance of feedback from the receiver to ensure the quality of communication meets the expectation [26]. In the same way, Harold Lasswell (1948) [27] came up with the Lasswell's 5W Model of Communication, which looks at the answers to the questions who (say), what (to), whom (in), which channel (with) and what effect to see if there is a chance that there is unclear communication [28].

Communication in the construction industry is described as the sharing of project information and methodologies to establish a mutually intelligible platform between the sender and the recipient [29]. Therefore, to interpret and communicate information efficiently, a project manager needs to develop interpersonal skills. Complex construction projects with many stakeholders have long raised the possibility of project communications management efficiency being compromised [30]. In addition, a project can involve a single unit, multiple units from the same organisation or even different organisations. Therefore, frequent communication among team members is needed to hinder any shortcomings in achieving project success [31].

Conversely, the COVID-19 standard operating procedure (SOP) imposed by the National Security Council (NSC) halts communication among team members. Moreover, most construction industry stakeholders were unable to make alternative communication plans due to the prolonged Movement Control Order (MCO) [11]. Additionally, in their study, Salami, Ajayia and Oyegoke (2022) [32] found that sudden restrictions imposed to eliminate infection caught many construction companies unprepared and the MCO by NSC do not work well with the industry since construction site activities require the physical presence of site labourers [33]. This undoubtedly adds to the obstacles that already exist in establishing reliable communication among team members.

The construction industry is essential to every nation's economic empowerment and success. The industry is responsible for generating employment prospects for billions of employees, both skilled and unskilled, worldwide [34]. Therefore, since the pandemic does not seem to show signs of slowing down, the industry must be revived soon with appropriate measures put in place. Acknowledging that it is possible for COVID-19 to be transmitted when an infected person speaks, coughs or sneezes, especially during a

conversation within close proximity, which usually happens in a construction site, the focus must be given towards introducing a safer communications management approach [13].

Pamidimukkala and Kermanshachi (2021) [17] found in a recent study that the most important COVID-19 challenges and strategies include coming up with new ways to manage communications and get around technical problems to improve communication when project managers and labourers are not available on a regular basis. Similarly, Al-Mhdawi et al. (2022) [35] summarised that common contractual-related discrepancies during the pandemic are caused by inefficient negotiation processes that result from ineffective communication mechanisms. It is almost certain that the pandemic has significantly changed the functional approach, hence prioritising improved communications management and socialisation patterns, particularly in adopting safer measures, are essential [36].

While communication is widely recognised as a vital component of project success, there is very few empirical research in this area. Then again, it is worth noting that project communications management procedures receive relatively less attention [37]. In fact, Molena and Rovai (2016) [38] highlighted that, given the emphasis on the necessity of communication and the prevalence of difficulties, the practices involved in project communications management receive inadequate attention. A study to understand the barriers in project communications management during a pandemic and the potential improving measures is the key to supporting actions towards ensuring project success [39]. In the first stage of this process, a systematic literature review was conducted to identify the communication channels that are utilised most frequently in the construction business. Therefore, based on the findings highlighted in several related publications, eleven common communication channels identified are: team meeting discussion; site review meeting; work breakdown structure (WBS); organisational breakdown structure; resource breakdown technology; employee suggestion scheme; structure; record management system; project reports; formal communication; and informal communication [26,31,40–50].

2.1. Project Communications Management Barriers

Miscommunication is inevitable in the construction industry due to its complexity and dynamism. It is considerably more sensitive when multiple stakeholders are involved in a single project. With multiple parties involved, information is frequently misinterpreted and delivered late. Incorrect and delayed information will invariably have an adverse effect on the success of a project. Additionally, messages are frequently communicated via ambiguous communication channels, which results in misunderstandings. The standard operating procedure (SOP) implemented by the Ministry of Health Malaysia (MOH) originally allowed for the presence of only half of the personnel on-site [51]. However, the current SOP established by the National Security Council (NSC) emphasises the importance of maintaining social distance at all times. This includes a drastic reduction in face-to-face discussions, group meetings, and crowding in common areas [14].

Other than that, the Department of Occupational Safety and Health, Malaysia (DOSH) and Ministry of Works, Malaysia (KKR), respectively, also issued SOPs pertaining to safety measures to prevent COVID-19 from spreading among construction site labourers [52,53]. According to Tang (2020) [54], miscommunication is highly possible due to the uncertainty caused by different SOPs during the COVID-19 pandemic. Teo and Loosemore (2001) [55] suggest that the lack of an industry norm or single technique will lead to misunderstanding and confusion, resulting in wasteful or repetitive operations. Based on the literature review, nine common communications management barriers faced in the construction industry, as illustrated in Table 1, are namely distorted information, multiple stakeholders, usage of technical jargon, unclear communication channels, language barriers, late information dissemination, lack of necessary skills, multicultural work environment and the personality factor.

Table 1. Common communications management barriers in the construction industry.

Communication Barrier	Safapour et al. (2021) [40]	Olaniran (2015) [49]	Zakaria and Singh (2021) [42]	Ejohwomu et al. (2017) [45]	Djajalaksana et al. (2017) [31]	Rahman and Gamil (2019) [50]	Wu et al. (2017) [56]	Nadae and Carvalho (2019) [48]	Holzmann and Globerson (2003) [46]	Valitherm (2014) [41]	Lee and Kim (2018) [26]	Abuarqoub (2019) [43]	Alzeraa et al. (2018) [44]	Frequency of Appearance
Distorted information	/	/	/	/		/	/		/	/	/	/	/	**11**
Multiple stakeholders	/	/	/	/		/		/	/		/		/	**9**
Usage of technical jargon	/		/	/	/		/	/	/			/		**8**
Unclear communication channel	/	/	/	/		/	/		/		/			**8**
Language barrier	/	/		/	/	/				/		/		**7**
Late information dissemination	/	/		/			/		/	/	/			**7**
Lack of necessary skills	/	/			/		/	/	/				/	**7**
Multi-cultural work environment	/	/	/	/	/					/		/		**7**
Personality factor	/		/		/	/		/		/			/	**7**

Source: Adopted and modified from [26,31,40–50].

It is reported that until August 2019, a total of 1.99 million foreign labourers were registered in Malaysia, where approximately 430,000 of them are listed under the construction industry [57]. These foreign labourers of different nationalities and educational backgrounds or skills constitute a series of issues that would burden the stakeholders, including miscommunication. Conceivably, Abuarqoub (2019) [43] and Valitherm (2014) [41] imply that language barriers are a significant communication risk for managers and foreign personnel. Yusof and Rahmat (2020) [58] stressed that failure to adhere to project communications management procedures on the project was exacerbated by the presence of a language barrier, which significantly and negatively influenced worker safety. This language barrier is worsening as foreign labourers, who come in various nationalities and speak a range of languages, slang, accents and dialects, may cause a severe breakdown in communication.

Progress reporting, leadership, attitude, a multicultural setting and a clearly defined communication channel are all cited as critical aspects in implementing good communication management [45]. Furthermore, due to inexperience and employees' attitudes, a convoluted communication channel generates distorted information flow [44]. Aside from that, late information transmission contributes to bad performance [49].

A study on the Dubai-Fujairah highway project found that inexperienced management employees and a lack of knowledge sharing among construction project labourers were discovered to be the two most significant communication barriers [29]. In a similar study, Akunyumu et al. (2019) [59] identified six project communications management barriers: restriction to information, cultural issues, delays in sharing information, technical challenges, lack of feedback and lack of cooperation. In addition, out of the 19 possible causes of miscommunication evaluated, technical jargon, language differences, refined information and self-interest were found as the most common hurdles to efficient communications management [31]. These elements that lead to miscommunication must be addressed and a suitable action plan has to be taken to overcome the situation.

In a recent study, Safapour, Kermanshachi and Kamalirad (2021) [40] discovered the possibility that the quality of communication between each of the major stakeholders could be improved by introducing technical features into the management of project communi-

cations. Safapour et al. (2021) [40] pointed out that technology assists project managers in allocating adequate resources to their projects and implementing proactive procedures that prevent miscommunications and the unintended effects of those miscommunications. Despite technical breakthroughs and innovations, it is still uncommon for the Malaysian construction industry to embrace various technologies due to various obstacles such as expense, price, culture and technical know-how [42].

2.2. Project Communications Management Improvement Measures

Ineffective communication significantly and adversely impacts project quality, cost, schedule and employee safety in the construction industry [60]. Poor communication can cause major delays in construction schedules. Miscommunication results in work being redone or corrected as a result of inaccurate information [58]. If there is insufficient project supervision, it is possible for the occurrence of communication breakdown, which causes project schedules to delay, and the cost of any given project may be substantially increased [61]. Khoury (2019) [61] further explained that overcoming communication barriers demands constant observation and consideration of potential obstacles that may arise during a specific communication session. It will be essential to employ different methods to overcome barriers in different circumstances, depending on the severity of the obstacles that must be overcome, and this will be the case because it will be necessary to employ different techniques to overcome barriers.

For example, the industry may opt for basic language training to overcome the language barrier between site labourers and the management team. The training modules may include upskilling of technical knowledge among site labourers, as most of them are not trained to work at construction sites [62]. Similarly, training may also be introduced to the management team on basic foreign language adequate for simple conversation. In multidisciplinary settings, such as the construction industry, where tasks are performed by individuals with varying skill sets across and within organisations, teamwork is sometimes taken for granted [63]. In most cases, the industry comprises numerous teams working toward the same goal. Hence, improvement measures implemented have to cater to both individuals and teams.

A study by Salami et al. (2022) [32] found that the implementation of work bubbles on construction sites to reduce unnecessary social and physical connections between labourers can aid in the containment of COVID-19. The concept was proposed to the construction industry, where interactions are allowed within a small, selected group of close labourers while maintaining proper hygiene practices, such as frequent handwashing and the use of face masks [32]. Zakaria and Singh (2021) [42] suggested that utilisation of related technologies, such as tracing applications, building information modelling (BIM), drones, virtual/augmented reality and robotics, will not only reduce human interaction but at the same time help improve worker's productivity while safeguarding their health, well-being and safety in line with the Sustainable Development Goal 8 (SDG8). Although this approach is viable, it requires early negotiations between the construction company and other stakeholders, particularly the contractors, to fully comprehend the impact of pandemics such as COVID-19 on the projects [64]. Early discussions also facilitate future planning, thus assisting in task sequencing and hence reducing overlap between site activities [65].

However, despite various approaches, it is crucial to determine the effectiveness of project communications management through these improvement measures during a pandemic [65]. A vitally important first step in improving communications management is developing a technique for measuring and assessing communication performance. Nevertheless, a variety of concepts, methodologies and definitions are used to measure communication performance [66]. Notably, communication performance is frequently defined in terms of how successfully the communication's objectives and functions are met [62].

According to Holzmann and Globerson (2003) [46], the Project Communication Management Index Model (PCMI) can be used to assess communication effectiveness because it is built on two areas of knowledge: project management and communications management. PCMI is primarily adopted to evaluate communications management protocol in terms of completeness, timing, correctness and volume, which are all aspects of overall communication efficacy [67]. On the other hand, Alzeraa et al. (2018) [44] and Kwofie et al. (2020) [62] added that the PCMI concept, which was initially developed by the Construction Industry Institute in 1997 and has been examined and enhanced, now has six important communication effectiveness variables: namely accuracy, timeliness, procedure, barriers, understanding and completeness. Table 2 displays six communications management efficacy measure commonly used in the construction industry.

Table 2. Common communications management efficacy measure in the construction industry.

Communication Efficacy Measure	Kwofie et al. (2020) [62]	Safapour et al. (2019) [67]	Alzeraa et al. (2018) [44]	Chi et al. (2021) [66]	Holzmann and Globerson (2003) [46]	Abramo and Onitiri (2010) [68]	Rahman and Gamil (2019) [50]	Hoezen, Reymen and Dewulf (2006) [69]	Valitherm (2014) [41]	Lunenburg (2010) [70]	Frequency of Appearance
Clarity	/	/	/	/	/	/		/	/	/	**9**
Specificity	/	/	/	/		/	/		/	/	**8**
Completeness	/	/	/	/	/	/	/			/	**8**
Barriers	/	/	/		/		/	/	/		**7**
Timeliness	/	/	/		/		/	/			**6**
Processes	/	/	/	/				/			**5**

Source: Adopted and modified from [41,44,46,50,62,66–70].

Seemingly, the way out from the current impact on existing communication protocol due to the COVID-19 pandemic is through revisiting and rejuvenating the project communications management procedures. Communications management effectiveness audits, such as PCMI, act as an impeccable tool to measure and ensure errors due to miscommunication are avoided [17,71]. The COVID-19 pandemic, on the other hand, has thrown everything into disarray. It is imperative that every measure to sustain the industry has to be utilised and adapted to deal with and overcome the site challenges caused by the pandemic [72].

3. Methodology

This study initially employs descriptive analysis to determine the segregation of foreign workers based on their nationality and the organisation to which the management team members belong to. On the other hand, the project communications management variables are analysed based on a basic research methodology concept using the Rasch measurement model. The Rasch model is developed on the concept of linearity to improve the precision; thus, it allows for a detailed examination with respect to the variables [73]. Very importantly, the Rasch model allows for the formation of a hypothetical unidimensional line along which items and individuals are graded according to their measurement difficulty and ability [74,75]. Therefore, the Rasch model enables researchers to clarify the meaning of a person measure by making use of the landscape that is established by the test items [76].

Figure 1 illustrates the flow of the research beginning from identifying the problem statement and objectives. The next step is a literature review that focuses on the topic of project communications management barriers and improvement methods in the construction industry during COVID-19, where the inputs are used to develop the questionnaire based on the problem statement and objectives. The questionnaire is divided into three sections which begin with questions related to demographic details required for the descriptive analysis. Sections 2 and 3 were developed based on the highlighted variables of project communications management barriers and improvement methods, respectively. The development of questions in Sections 2 and 3 were guided by the six essential communication effectiveness variables. Since half of the targeted respondents belong to foreign workers, the questionnaires were translated with the assistance of representatives from different foreign embassies and high commission representatives and a pilot test was conducted to assess the validity and reliability of the questionnaires. Subsequently, the questionnaires were distributed to foreign workers and management team members. At the time when data collection was carried out, at the end of May 2020, the government of Malaysia enforced the Conditional Movement Control Order (CMCO) which allowed only projects deemed crucial, and contractors who are able to adhere to the stringent guidelines imposed, to carry out site activities. Complying to the guidelines increased costs; therefore, only a number of construction sites, mainly supervised by Class F contractors, registered with the Construction Industry Development Board Malaysia (CIDB) resumed, and at the critical site areas within their project. Out of all, only four construction sites allowed access for data collection. Since it involves small site areas, the number of foreign workers and team management were less than 130 individuals, respectively, hence the entire workforce were interviewed. However, only 100 questionnaires, respectively, were found to be complete and this met the minimum sample size proposed by Krejcie and Morgan (1970) [77]. The questionnaire encompassed 66 items developed, based on six essential communication effectiveness variables and 11 project communication channel elements, taking into consideration communications management improvement measures in the construction industry during the COVID-19 pandemic.

It is notable to mention that the study adopted a non-probability purposive sampling method to determine the respondents among foreign labourers and management teams by approaching construction companies that have resumed operations under the strict standard operating procedure issued by the National Security Council (NSC), and based on their willingness to cooperate and to allow their employee to participate in a questionnaire-based survey. This sampling method is ideal for exploratory research design [78] since the research topic is rather new and there are very few related studies conducted thus far in the area of project communications management [32,36,66].

During the exercise, a large number of foreign workers required assistance when answering the questions and they were guided without influencing their inputs. The number of survey team members has been reduced and they are obligated to follow the standard operating procedures (SOPs) established by COVID-19, which stipulate that all survey team members must undergo a mandatory swab test and keep physical contact to a minimum at all times. Survey team members had to use appropriate personal protective equipment throughout the data collection period. Survey activities were broken into several sessions and were only allowed to be conducted early morning during the arrival of foreign workers and management team members to the site. This was to avoid any interruption towards the scheduling of site activities. Physical presence of the survey team was instrumental in ensuring all respondents were well briefed on the intention of the study and all completed questionnaires were returned during every session.

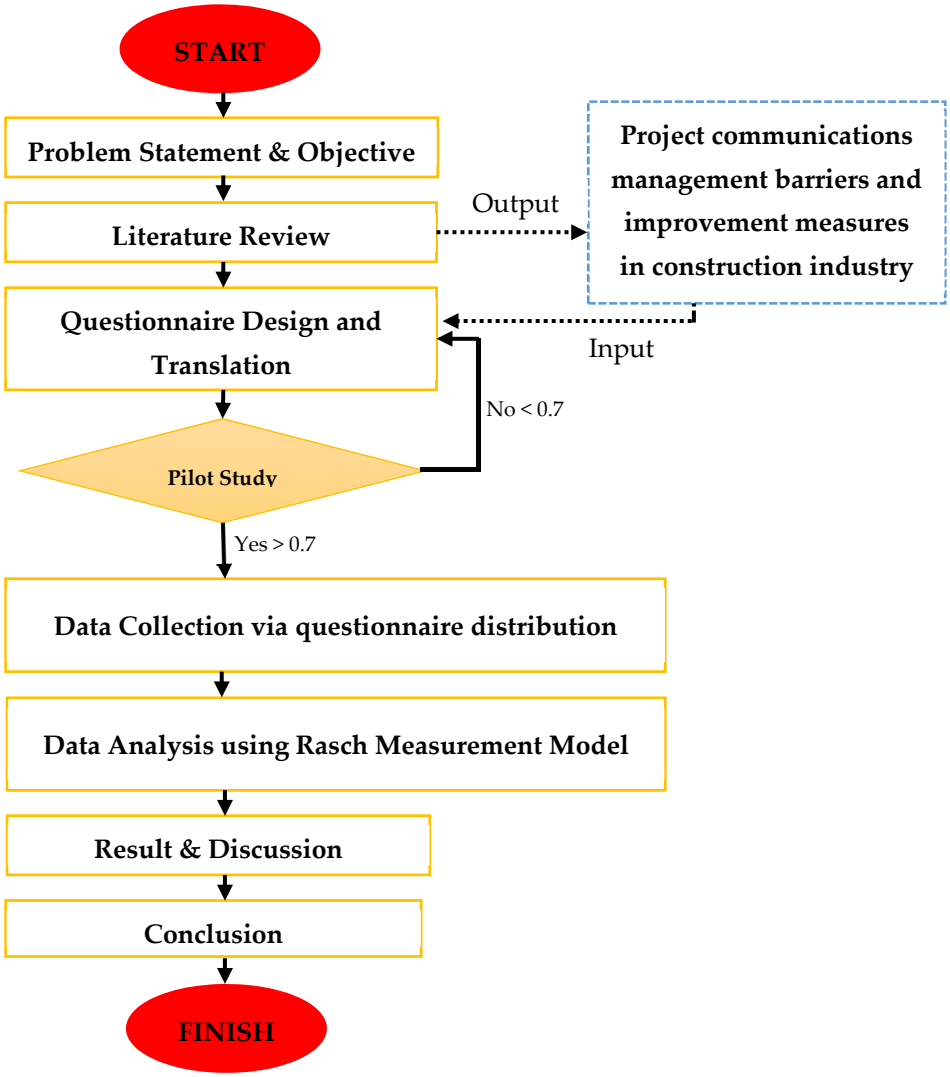

Figure 1. Research Methodology [79].

The purpose of the pilot project was to determine how consistent the data collection was and to ensure that the instrument employed was reliable enough to continue the study. Cronbach's alpha (α) measures internal consistency, with an optimum value between 0.7 and 0.9 [79]. However, according to George and Mallery (2003) [80], Cronbach's alpha values of less than 0.6 are deemed low, whereas values of 0.7 and above are considered acceptable. Survey data from the completed questionnaires were organised to meet the format required and analysed through the Rasch measurement model using WINSTEPS software. Analysis using the Rasch model starts with the reliability and validity test to ascertain the quality of the instrument and respondents. Further to it, unidimensionality analysis is meted to evaluate the internal consistency and measure between variables. This is followed by item misfit analysis which is based on correlation analysis that determines the outlying variables that may be revised or omitted from further analysis. Finally, the person–item distribution map analysis is carried out to determine the criticality of variables tested based on the respondents' feedback.

4. Result and Analysis

4.1. Respondent Demography

Although 130 questionnaires were circulated among foreign labourers and management team members, respectively, only 100 questionnaires from each group were deemed complete. Figure 2 illustrates the breakdown of respondents among foreign labourers

approached to examine communications management barriers. The foreign labourers were mainly from Indonesia, Pakistan and Bangladesh. On the other hand, Figure 3 depicts the organisation type of respondents from the management team. It is noticeable that most of the respondents are developers, followed by consultants and contractors.

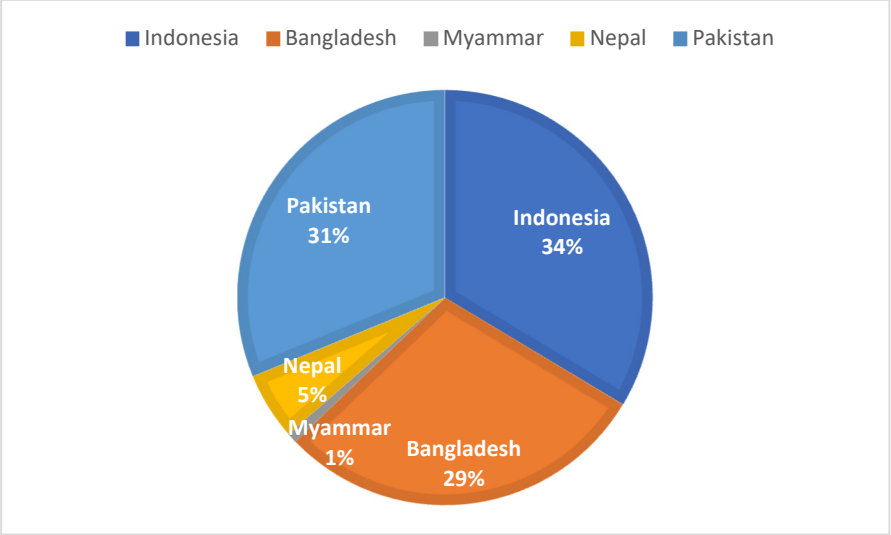

Figure 2. Breakdown of foreign labourers approached to examine communications management barriers in the construction industry during the COVID-19 pandemic.

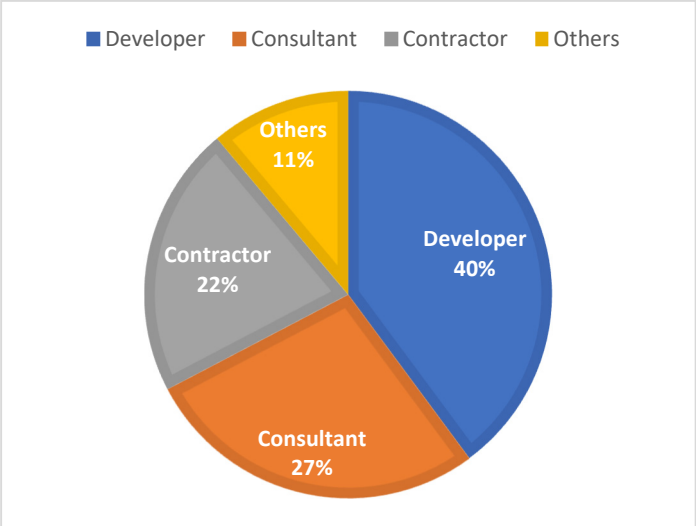

Figure 3. Breakdown of organisation type among management team approached to identify communications management improvement measures in the construction industry during the COVID-19 pandemic.

4.2. Examining Communications Management Barriers in the Construction Industry during the COVID-19 Pandemic

4.2.1. Reliability and Validity Analysis

Referring to Table 3, the instrument utilised in this study is optimum and reliable, with α value of 0.98 [79,80]). Additionally, the Person Reliability (β) value of 0.97, along with a Standard Error (SE) of 0.28, indicates that respondents were competent to complete the questionnaire survey [74]. Furthermore, the organisation's statistics investigation on Mean Square (OMNSQ) and z-score (OZSTD) revealed that OMNSQ is 1.09 and OZSTD is −0.5. This indicates that the respondents were from the most appropriate group that was able to

reflect on all 66 items. Apart from that, the dataset is productive for the measurement of latent traits, as well as acquiring reasonable predictability.

Table 3. Summary of 100 measured person for examining communications management barriers in the construction industry during the COVID-19 pandemic.

	Count	Measure	Model Error	Infit		Outfit	
				MNSQ	ZSTD	MNSQ	ZSTD
Mean	203.9	0.04	0.25	1.2	−0.4	1.09	−0.5
S.D.	90.8	2.31	0.18	0.75	3.8	0.66	3.7
Max.	329.0	5.94	1.01	2.89	6.4	3.47	6.3
Min.	68.0	−4.32	0.11	0.03	−9.7	0.03	−9.7
Real RMSE 0.39	**TRUE SD**	2.27	**Separation**	5.84	**Item Reliability**		0.97
Model RMSE 0.31	**TRUE SD**	2.29	**Separation**	7.45	**Item Reliability**		0.98

S.E. OF Person MEAN = 0.28.

4.2.2. Person–Item Distribution Map

A 66-item questionnaire survey was constructed based on six essential communication effectiveness variables and 11 project communication channel elements with the underlying element of communications management barriers in the construction industry during the COVID-19 pandemic. Then, questionnaires were handed out to 130 foreign labourers in Malaysia's construction industry; however, only 100 questionnaires were completed accordingly.

Figure 4 displays the results obtained through the person–item distribution map analysis (PIDM), where only eight items are highlighted as strongly agree, namely CSR4 (inability to grasp meeting specifics), CRM4 (unable to grasp technical details), CTM6 (insufficient record-keeping details), CPR5 (upper management delays project report information), CFC6 (insufficient formal information), CSR3 (language skills hinder site review meetings), CIC1 (unable to interpret informal communication due to site situation) and CFC5 (upper management delays information flow).

Whereas, the 29 items categorised as agree are CPR3 (project report documents are restricted), CPR4 (not comprehending technical project reports), CPR6 (project reports lack depth), CRM3 (record management system restricted), CRM6 (insufficient record-keeping details), CRB1 (site situation prevents understanding resource breakdown structure), CWB1 (difficult to understand work breakdown structure depending on site condition), CWB2 (work breakdown structure methods are complicated), CSR6 (inadequate site review meeting details), CWB5 (upper management's delay in sharing work breakdown structure information), CRB2 (complicated resource breakdown structure methods), CRB4 (unable to grasp technical details), CIC2 (informal communications confusing), CIC6 (informal communication misses out specifics), CPR1 (site condition prevents understanding project reports), CRM1 (not able to maximise record management system depending on site condition), CIC3 (restricted informal communication files), CIC4 (unable to comprehend informal tech specifics), CES5 (upper management's delay in implementing employee suggestions), CFC2 (formal instructions are complex), CRM5 (upper management's delayed resource breakdown structure information), CIC5 (upper management's informal communication lags), CRB5 (upper management's delayed resource breakdown structure information), CES3 (employee suggestions scheme are restricted), CTM1 (labourers are underrepresented in team meetings and do not comprehend the site condition), CTM2 (complicated team meeting discussion protocols), CTM3 (low language skills hinder team meeting discussion), CTM4 (difficult to understand team meeting discussion specifics) and, finally, CTM5 (absence of regular team discussion meetings).

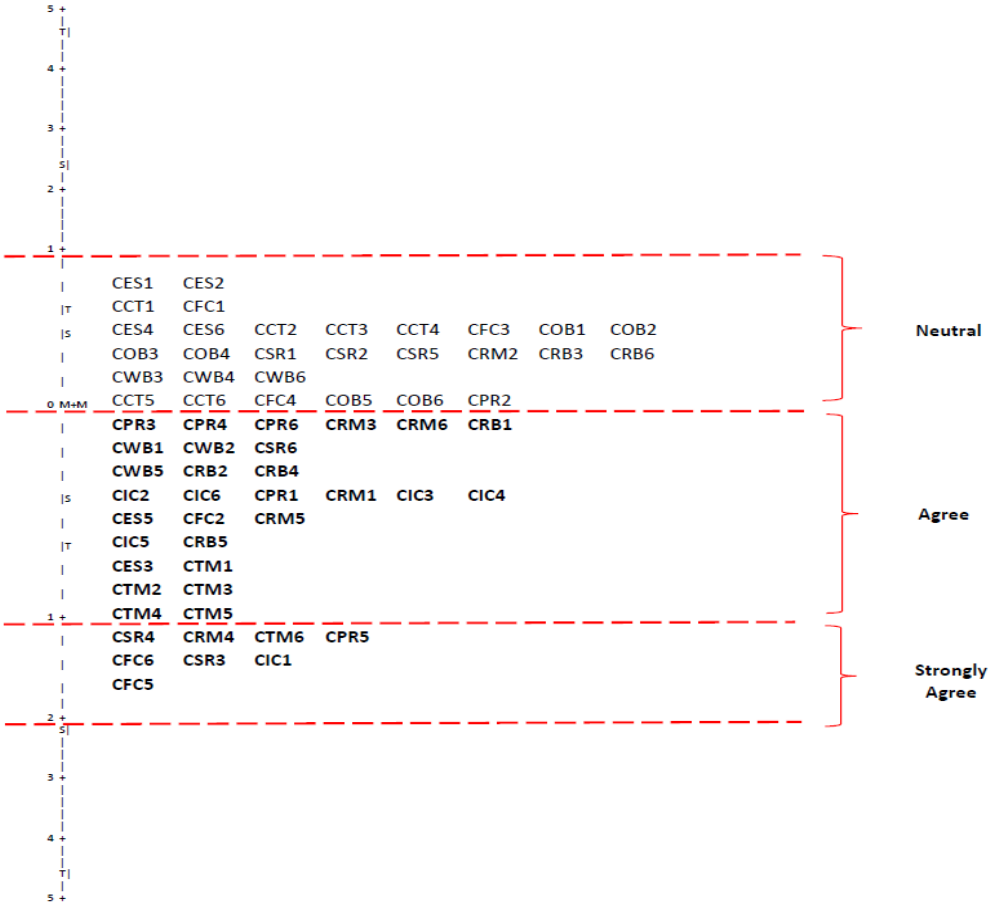

Figure 4. Person–Item Distribution Map (PIDM) for examining communications management barriers in the construction industry during the COVID-19 pandemic.

4.3. Examining Communications Management Improvement Measures in the Construction Industry during the COVID-19 Pandemic

4.3.1. Reliability and Validity Analysis

Referring to Table 4, the α value of 0.92 indicates that the instrument used in this study is optimum and reliable [79,80]. Another essential point is that the Person Reliability (β) value of 0.95, along with a Standard Error (SE) of 0.20, shows that respondents were competent to complete the questionnaire survey [74]. Furthermore, the organisation fit statistics investigation on Mean Square (OMNSQ), and z-score (OZSTD) revealed that OMNSQ is 1.00 and OZSTD is −0.9. This indicates that the respondents were from the most appropriate group that was able to reflect on all 66 items. Additionally, the dataset is productive for measuring latent traits and acquiring reasonable predictability.

Table 4. Summary of 100 measured person for identifying communications management improvement measures in the construction industry during the COVID-19 pandemic.

		Count	Measure	Model Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean		273.3	3.19	0.26	1.01	−0.9	1.00	−0.9
SD		32.3	1.94	0.10	0.79	4.5	0.78	4.4
Max.		329.0	8.57	1.01	5.57	9.9	5.54	9.9
Min.		187.0	−0.92	0.19	0.04	−9.2	0.04	−9.2
Real RMSE	0.31	**True SD**	1.91	**Separation**	6.16	**Item Reliability**		0.92
Model RMSE	0.28	**True SD**	1.92	**Separation**	6.75	**Item Reliability**		0.95

S.E. OF Person MEAN = 0.20.

4.3.2. Person–Item Distribution Map

Figure 5 illustrates the result derived through the person–item distribution map analysis (PIDM). The result indicates that only seven items are highlighted as strongly agree, namely IMPR2 (usage of clear and specific instruction increases understanding of project reports), IMSRM3 (encouragement to participate during the site review meeting increases the understanding), IMSRM5 (regular site review meeting to discuss site progress increases the understanding), IMSRM2 (usage of clear and specific commands increases understanding during the site review meeting), IMTMD1 (identification of an appropriate representative to attend the team meeting discussion increases the understanding of instructions), IMTMD3 (encouragement to participate during the team meeting discussion increases the understanding) and IMSRM1 (identification of an appropriate representative to attend the site review meeting increases the understanding of instructions).

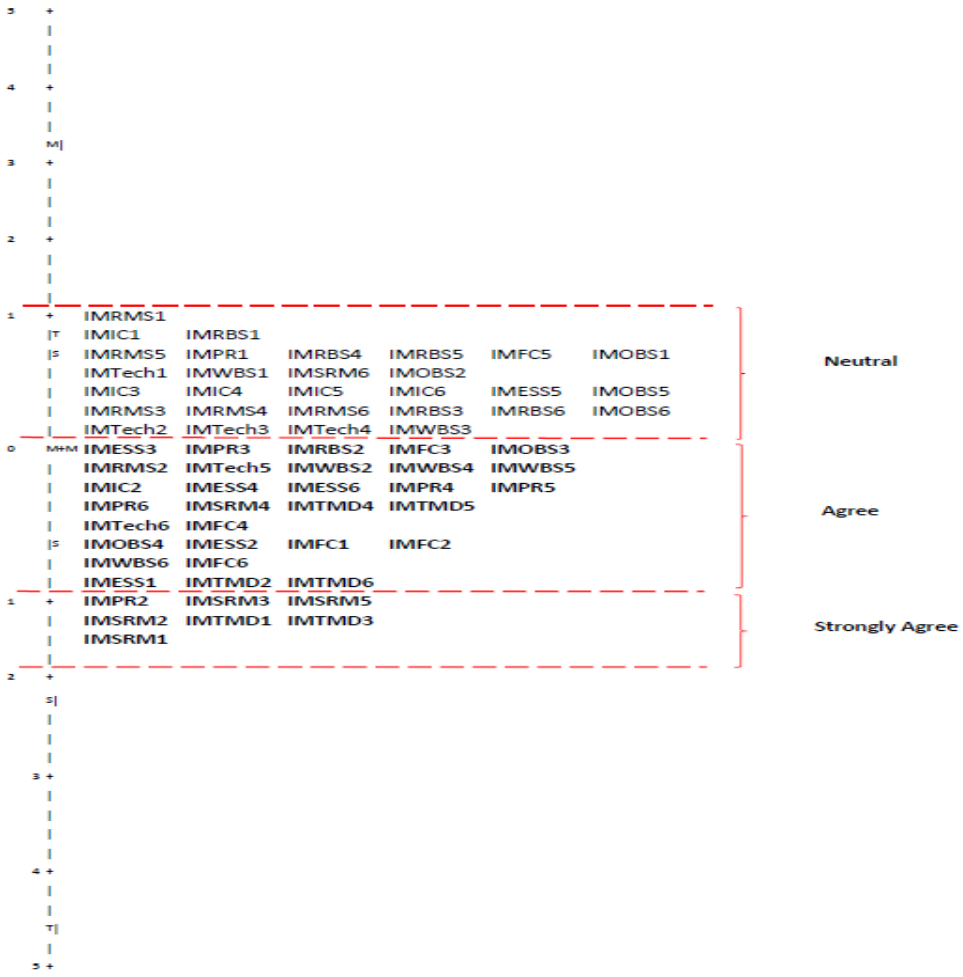

Figure 5. Person–Item Distribution Map (PIDM) for identifying communications management improvement measures in the construction industry during the COVID-19 pandemic.

According to the result analysis, 30 items fall under agree. The items are IMESS3 (improved accessibility of the employee suggestion scheme through various communication platforms increases the understanding), IMPR3 (improved accessibility to project reports through various communication platforms increases the understanding), IMRBS2 (usage of clear and specific instruction increases understanding of the resource breakdown structure), IMFC3 (improved accessibility of formal communication through various communication platform increases the understanding), IMOBS3 (improved accessibility of organisation breakdown structure through various communication platforms increases the understanding), IMRMS2 (usage of clear and specific commands increases understand-

ing of information in the record management system), IMTech5 (development of a plan for quick information dissemination through technology based communication platform increases the understanding), IMWBS2 (usage of clear and specific instruction increases understanding of the work breakdown structure), IMWBS4 (usage of simple instruction approach increases the understanding of the work breakdown structure), IMWBS5 (development of a plan for quick information dissemination increases the understanding of the work breakdown structure), IMIC2 (usage of clear and specific instruction increases understanding of informal communication), IMESS4 (usage of multi lingual/simple instruction approach in the employee suggestion scheme increases the understanding), IMESS6 (assurance of important and relevant information required in the employee suggestion scheme increases understanding), IMPR4 (usage of simple instruction approach increases the understanding of project reports), IMPR5 (development of a plan for quick information dissemination increases the understanding of project reports), IMPR6 (assurance of important and relevant information dissemination increases understanding of project reports), IMSRM4 (usage of simple instruction approach during the site review meeting increases the understanding), IMTMD4 (usage of simple instruction approach during the team meeting discussion increases the understanding), IMTMD5 (regular team meeting discussion related to site progress increases the understanding), IMTech6 (assurance of important and relevant information dissemination through the technology based communication platform increases understanding), IMFC4 (usage of simple instruction approach increases the understanding of formal communication), IMOBS4 (usage of simple instruction approach increases the understanding of the organisation breakdown structure), IMESS2 (usage of clear and specific instruction in the employee suggestion scheme increases understanding), IMFC1 (implementation of multilingual instruction increases the understanding of formal communication), IMFC2 (usage of clear and specific instruction increases understanding of formal communication), IMWBS6 (assurance of important and relevant information dissemination increases understanding of the work breakdown structure), IMFC6 (assurance of important and relevant information dissemination increases understanding of formal communication), IMESS1 (encouragement to express views through the employee suggestion scheme increases understanding), IMTMD2 (usage of clear and specific commands increases understanding during the team meeting discussion) and, lastly, IMTMD6 (assurance of important and relevant information discussed during the team meeting discussion increases the understanding).

4.4. Summary of Critical Variables for Project Communications Management Barriers and Improvement Measures in the Construction Industry during the COVID-19 Pandemic

Out of eleven communication channels examined, the respondents strongly agreed that only six of the channels experienced a highly significant communication barrier during the COVID-19 pandemic: site review meetings, team meeting discussion, project reports, formal communication, informal communication and record management system. In the same way, the respondents also strongly agreed that three improvement measures would vehemently improve communications management during the COVID-19 pandemic, namely site review meetings, team meeting discussions and project reports. Table 5 summarises the respondent feedback on communications management barriers and improvement measures in the construction industry during the COVID-19 pandemic.

The analyses show that respondents consisting of foreign workers face difficulties in grasping the details discussed during site review meetings, especially information related to technical elements of the project. They also indicated that language caused various other communication issues that leads to misinterpretation of instruction. Additionally, the respondents highlighted that information is not disseminated instantly. On the contrary, respondents belonging to the management team expressed that it can be overcome through organising frequent meetings while encouraging meeting members to participate actively and emphasise usage of clear and specific commands throughout the meeting. The results

clearly suggest that most critical barriers can be overcome by identifying the appropriate representative amongst the foreign workers to attend meetings and discussions.

Table 5. Summary of critical variables for communications management barriers and improvement measures in the construction industry during the COVID-19 pandemic.

Critical Variables	Agree		Strongly Agree	
	Communications Management Barrier Items	**Communications Management Improvement Measure Items**	**Communications Management Barrier Items**	**Communications Management Improvement Measure Items**
Site Review Meeting	CSR6		CSR4 CSR3	IMSRM2 IMSRM1 IMSRM3 IMSRM5
Team Meeting Discussion	CTM2 CTM4 CTM3 CTM1 CTM5	IMTMD2 IMTMD4 IMTMD6 IMTMD5	CTM6	IMTMD1 IMTMD3
Project Reports	CPR3 CPR4 CPR6 CPR1	IMPR6 IMPR3 IMPR4 IMPR5	CPR5	IMPR2
Formal Communication	CFC2	IMFC4 IMFC6 IMFC2 IMFC3 IMFC1	CFC6 CFC5	
Informal Communication	CIC2 CIC6 CIC5 CIC3 CIC4	IMIC2	CIC1	
Record Management System	CRM3 CRM6 CRM5 CRM1	IMRMS2 IMRMS4	CRM4	
Work Breakdown Structure	CWB1 CWB2 CWB5	IMWBS6 IMWBS2 IMWBS4 IMWBS5		
Organisational Breakdown Structure		IMOBS4 IMOBS3		
Resource Breakdown Structure	CRB2 CRB4 CRB1 CRB5	IMRBS2		
Technology		IMTech6 IMTech5		
Employee Suggestion Scheme	CES5 CES3	IMESS3 IMESS1 IMESS4 IMESS2 IMESS6		

Generally, respondents agree that all communication channels except technology and organisational breakdown structure experienced an interruption in conveying information among project team members during the COVID-19 pandemic. In the meantime, the respondents opined that all communication channels except for site review meetings could act as an improvement measure in overcoming the barriers.

5. Discussion

Overall, the study identified that six out of eleven commonly used communication channels in the construction industry pose high communication breakdown risks. The communication channels that face significant barriers are site review meetings, team meeting discussions, project reports, formal communication, informal communication and record management systems. This reveals that COVID-19 has a detrimental impact on the management of project communications, which is an essential component PMI (2017) [15] in the construction industry that requires remedial measures. Moreover, Ne'Matullah, Pek and Roslan (2021) [81] vehemently stressed that poor communications management approach in the construction industry is the main cause of project failures. Hence, Akunyumu et al. (2019) [59] recommended that the shortfall in project communications effectiveness has to be given prompt attention and solution: this should be carried out during the project planning stage.

Similarly, the study highlighted that while adhering to COVID-19 related standard operating procedures (SOP), foreign labourers experience difficulties understanding the technical details due to language proficiency during site review meetings. Considering the employment of foreign labourers from various nationalities in the Malaysian construc-

tion industry, Ne'Matullah et al. (2021) [81] pointed out that the different cultures and languages will threaten effective communication. As identified by Abuarqoub (2019) [43] and Valitherm (2014) [41], language limitations can result in miscommunication issues in the construction industry, such as misunderstanding, information misinterpretation, distorted communications, disinformation, ambiguity, mistrust and uncertainty. Since the construction industry is already plagued with issues arising from language barriers, COVID-19 SOPs that restrict large group gatherings and face-to-face discussions have certainly worsened the situation among foreign labourers. In addition, findings also reveal that foreign labourers could not decipher informal communication, such as on-site verbal instructions and gestures.

The respondents also expressed that there is a noticeable absence of important discussion details during formal communication (on-site instruction), team meetings and applied record management system, which leads to a poor understanding of planned site activities. The study reveals that foreign labourers experienced delays in receiving information through formal communication (on-site instruction) and project reports prepared by the management. The findings suggest that the construction industry was unprepared and failed to execute alternative communication plans to face the pandemic. Likewise, ILO (2021) [9] and Salami et al. (2022) [32] express that impact on the existing communications management plan by COVID-19 has been severe due to a lack of prior preparation for alternative communication mechanisms. During the COVID-19 insurgence, most companies were caught off guard and struggled to ensure correct and apt information was relayed to site labourers who were physically required to conduct activities [65].

Complementary to the significant barriers identified, the study also examined various improvement measures that potentially would be able to overcome the project communications management related issues caused by the COVID-19 SOP. Out of eleven communication channels scrutinised, only three fell under the category of significant. The three communication channels are site review meetings, team meeting discussions and project reports. The respondents expressed that identifying an appropriate representative to attend the site review meeting and team meeting discussion with the encouragement to participate will increase the understanding of instructions, specifically when adhering to the COVID-19 SOP, which limits physical presence. Similarly, Ogunnusi et al. (2021) [36] stressed that meeting-based discussions should be exclusive to only the most relevant individuals during the pandemic and preferably conducted using web-based platforms.

Effective, clear, succinct, full and accurate communication contributes to the establishment of improved communications management, especially when individuals with diverse backgrounds and experiences are involved [26]. Likewise, the findings suggest that using clear and specific commands during site review meetings and in project reports significantly improves communications management during the pandemic. The study also highlights that regular site review meetings to discuss site progress improve understanding. Jones et al. (2022) [65] examined a few construction companies in London and found that communication between site managers and site labourers during the COVID-19 pandemic has to be conducted frequently with substantive feedback and views exchanged between the two parties, while complying to the restrictions imposed.

Jallow et al. (2020) [33] pointed out that communication with project teams was most effective when using technical means, such as video chat and internet-based meetings. Similarly, Zakaria and Singh (2021) [42] advocated a crucial necessity to utilise and implement construction industry-related technology in order to manage and address site-related COVID-19 pandemic challenges. On the contrary, although technology adoption has been tipped to be the best improvement measure to overcome the current shortfall caused by the COVID-19 pandemic, the study did not reflect such. Pamidimukkala and Kermanshachi (2021) [17] explained that due to the industry's uniqueness, which involves numerous stakeholders, physical discussions during the pandemic will still be required to ensure valuable information is communicated effectively. In the same way, Jeffres (2015) [32] suggest that as a remedial measure, prior consultations between the con-

struction company and other stakeholders, particularly the contractors, are conducted to ascertain how the COVID-19 pandemics may affect the projects.

6. Conclusions

Project communication management plays a significant role in suppressing infection among labourers, while limited efforts are put to investigate the barriers to implementing an effective communication management in construction sites. As one of the first of its kind, this study investigated the most critical communication management barriers and measures using the Rasch measurement model. The findings showed that there are six and three significant communication barriers and improvement measures, respectively. In light of the results of this research, it was concluded that, as part of the efforts to swiftly revive the construction industry from the present downtrend, the adequate focus should be given to project communications management plans, especially on-site review meetings, and team meeting discussions and project reports.

Using Malaysia as an exemplar of a developing country with the adoption of low levels of automation in the construction industry and a high reliance of the presence of skilled and unskilled labourers this study contributes to the field in several ways. First, the study has paved the way towards implementing new approaches that would produce immediate results and create a safer working environment. The findings are practical measures that can be deployed without significant cost occurrence. As a result, governing bodies and stakeholders may adopt the outcome of this study to make necessary amendments to existing standard operating procedures, policies or even regulations that would benefit the employees, especially regarding healthcare, and ensure project continuity. Second, it indirectly benefits the construction industry, which is important for economic expansion and makes it easier to plan for future development in accordance with Malaysia's Shared Prosperity Vision 2030 (SPV2030) and the Twelfth Malaysia Plan (RMK-12). Third, other industries that depend on foreign labourers and require a physical presence, such as fishery, manufacturing, plantation, agriculture and mining may adopt the findings to suit the needs of their respective working environments. Subsequently, they can safeguard employability and maintain decent work for individuals related to the industry, thus supporting the spirit of United Nations Sustainable Development Goal 8 (SDG8).

However, it is noticeable that the sampling for the study was limited by access to construction sites due to regulations and safety measures. As a result, some of the critical variables may not be practical solutions for all types of construction sites, while they may potentially act as guiding principles towards developing a suitable communication plan. Considering the above for a better understanding of the industry's needs, the applicability and importance of such variables should be investigated on other construction sites and stakeholders in the form of future research on the topic. Moreover, other methodologies such as different types of multi-criteria decision-making approaches can be employed to determine the importance of the investigated variables.

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