

# Effectiveness of Virtual Team for Improving Communication Breakdown in IBS Project Delivery Process

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**Abstract**— Technological innovation and globalization force the organizations collaborate across time, culture, and geographical boundaries. It becomes one of the ordinary practices to the construction sector and has given rise to the concept of global teams known as a virtual team. Virtual team drives by advance technology to solve the communication issues and perceived as an effective, efficient, and creative team structure. Effective communication is an essential process to develop project success in the construction Industrialised Building System (IBS) project. However the implication of the fragmented approach in the IBS project development process was reflected in the lack of communication between multidisciplinary project teams cause various problem such as lower performance and a higher turnover of staff. Therefore, this research aims to investigate the effects of communication, subject to different project stage and to identify the key factors to enhance virtual team communication processes between the practitioners.

**Keywords**— *Industrialised Building System (IBS); construction management; fragmentation; communication; virtual team.*

## 1. Introduction

Industrialized Building System (IBS) is new modern construction method are taken as an initiative by the Malaysian government in an attempt to develop a sustainable construction process [1]. The development of IBS system is under transformation program by the Malaysian government to surge social economic from pre-industrialized to industrialised state.

Industrialisation are the process strategy that alter from traditional construction process into manufacturing and assembly process in direction to

improve quality of the product, minimise cost and time [2]. The IBS components are manufacture systematically done by using machine, formworks and others mechanical equipment before delivered to the construction site for assembly and erection. Definitely IBS is the process producing standardized building component either on or off-site and all parts of the component will be transported and erected into a structure using appropriate machinery and equipment at the construction site with minimum site work [3], [62].

The use of IBS method required extraordinary effort from practitioner to change from the existing construction process into the new modern construction with specialized skill, knowledge and efficiencies team to assemble and coordinate process implement. In addition, IBS construction has different stage, according to the type of project and demographic. Moreover, the stage of project consists of five processes which are initiating, planning, executing, monitoring and closing. The process started with design the prefabricated component at manufacturing yard base on specific dimension and specification. After that the component will transported to the construction site from the factory for installation.

This situation required extensive work and additional strength from practitioners to monitor and control the process and to deliver the building material to site project. If not undertaken several problems may negatively affect the project on quality, cause substantial delays, increases in cost and imply all project parties to higher risk chances in comparison with traditional nearby projects, insufficient communication, mistrust and arbitration. Others factor is related to termination of contract, weather condition, design errors, shortage

of skilled labour and improper planning and scheduling.

## 2. Background of the Research

The construction industry is one of the most information-dependent industries [4]. Hence, quality of communication is a key factor in the success of construction projects and is one of the common risks on construction project [5], [6]. Poor communication further complicated by differences from conventional mind-sets, information flow, scheduling and knowledge. Moreover that will become increasingly complex when team members from many organisation are located in different location [7]. Then inaccurate communication process or misinterpreted during the project can directly increase unnecessary expenditure, project risk on quality, duration of the project, lower performance and effective of communication may be compromised [8].

Moreover, involvement by multi teams on a construction project with diverse expertise from different organizations and stage or type of project and demographic difficulties to achieve effective information between team members or organization. That has been criticized that the different stage processes of work with several position create a challenging to developed integration and effective communication within project team members [9]. The breaking into small part of the process frequently has negative impact on connectivity and this situations as known as fragmented process [10].

Fragmentation is the common problem in the construction and that can be described into two phenomena which is the landscape of construction industry structure involved with a large number of small firms [13] and secondly separation of design and construction stage [14]. On the other hand, according to previous literature has been described fragmentation in two levels, such as horizontal; multiplicity of entities of individuals, organizations, and business units; and vertical fragmentation illustrate as a functional process by stage or divide into components [15]. Figure 1 illustrates the two levels of fragmentation.

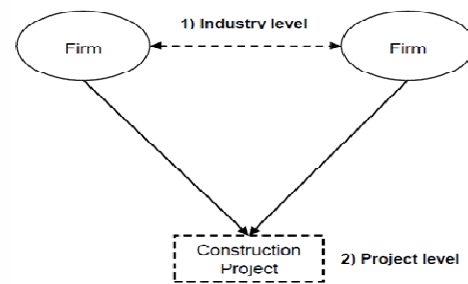


Figure 1. Level of fragmentation

Table 1. Definition of fragmentation based on two levels

Industry level	Project level
Variations in regulation, complexity of services, and market [59].	Complexity of the project, delivery requirement, high degree of specificity, location based activities [60]
Large number of small firms causing industry segregation.	Activities and entities involved at the project level, including the separation between the design and construction stages, and the limited coordination and integration within the project team.
Involves disintegration of expertise, situated knowledge, and specialists' inability to work together efficiently [61]	Vast divide between the design and construction stages [10]

These two types of fragmentation closely related to the characteristic of construction project including complexity of the project, delivery requirements, high degree of specificity, and location-based activities. Therefore, "... the efficiency of project delivery is presently constrained by the largely separated processes through which they are generally planned, designed and constructed [16]. These processes reflect the fragmented structure of the industry and sustain a contractual and confrontational culture". Therefore fragmentation will contribute too many factors including poor

communication and co-ordination between different functional disciplines, lack of trust, knowledge sharing and temporary collaboration of stakeholders. Contractors should consider filed management and project process management, but also improved project communications to reduce rework [17]. Therefore, the quality of communication is the vital element to success and important to understand in developing IBS construction project [18]. As a result, effective communication can bring team members in construction project together, thereby integrate within others team from diverse background, connecting with various cultural different level expertise, various perspectives and interest in the project execution or outcome [21]. In fact, extensive of coordination of design, transportation, tracking and installation need effective communication to ensure successful IBS project implementation [21].

### 3. Research method

This paper presented is primarily based on the relevant literature review within the scope of virtual teams and industrialised Building System (IBS). Through the literature review, definition and communication issues of Industrialised Building System (IBS) and virtual team approach was identified to examine the effective way contributed effective team communication. All the data and information gathered directly from articles and other printed materials searched in the international and national journals, and proceeding. This literature review is very important and helpful in the process of developing for the theoretical sections of the actual research.

## 4. Challenges construction phase

### 4.1. Design and Planning Process

In general, construction industry involved with multi team such as client, consultant, contractors, sub-contractors, engineer and quality surveyor. Normally project team members are temporary and involved in the project at different times, they are from different organisation and culture with specific skill and specialised [23].

The communication between team is pivotal to success the project with advance communication technology during the planning stage. Reliable support communication tool between the various

parties must be established during the planning stage to improve integration, accurate data and effective dealing with project documents. Any problem of communication can lead to severe misunderstanding and therefore, delays in the execution of the project.

For instance, the current industry structure has much potential point for conflicts when each participant tries to pass on the risk to others within the work [24]. It is clearly present in the diversification of the goals of the designers and builder, whereas “the designer wants a functional design that reflects his philosophy and the builder wants a buildable product within reasonable risk limitations” [25]. It clearly shows that ‘conflicts, inconsistencies and mismatches’ between all of project team members which is possibly due to simple misunderstandings or assumptions problem is mainly caused by the current construction traditional practice [27].

### 4.2. Construction Phase

This phase involves by process of implementation, installation and erection IBS component on construction sites. All the process required high-quality skill workers to accomplish the installation process which depends more on machine oriented skills [28]. Moreover reliance to foreign worker required more time and investment to provide intensive training to generate IBS skill and knowledge as well that will upshot on quality of product [29].

Great planning is crucial in estimating the delivery time of IBS components to ensure it is in-line with the preparation of the site. Currently, most of the IBS manufacturers and factory located in west peninsular Malaysia and this will be resulted to ineffective distance to a site which located far from manufacture location. In addition, large scale IBS component normally been carried out off-site which required transportation medium in shifting the components from the production site to the construction site. In order to coordinate processes and deal with critical scheduling from the beginning until the project completion, effective communication channel across the supply chain need to be established in order to overcome from inadequate planning, transportation cost and accidents.

Furthermore, others problem are associate to technical issues, where is low interfaces tolerances

in between components is during installation process [30]. For example to joining different module or component and electrical connection between factory made and site installed. Therefore understanding and sharing knowledge is required in coordinating the complex of interfacing problem if not undertaken it can affected on quality of the building.

### 4.3. Post construction

Poor qualities where after project completed. These factor contributed to IBS building are defects (cracks, blemishes, moisture penetration, water leakage) which resulting from inadequate technical knowledge, shoddy of skill and poor quality control which causes aesthetic and functional faults [31].

Below are list of major problem in IBS construction project delivery process. The entire problem required effective communication delivery process to enhance knowledge sharing between each process implementation.

**Table 2.** Entire problem reflect to ineffective communication

Phase	Problem
Planning & Design	Lack of cooperation between teams, inaccurate design information, reluctance to accept opinion, inaccurate data, late updating information, trust
Manufacturing, Transportation, Installation and construction	Lack of skill, Knowledge, conflict of work, poor planning and coordination, not standardize building component, Low monitoring

### 4.4. Factor influencing communication in construction

#### 4.4.1. Complexity of the project

Today, increasing technological complexity is shifting project control toward specialised subcontractors. More complex buildings have necessitated design input from an increasing range of specialist sub-contractors [32]. This increasing number of specialist sub-contractors requires effective management of the interfaces between

these organisations. It presents the project communication a great challenge.

#### 4.4.2. Communication timing

Project Management Institute was mention communication should be schedule meet the demands of the project participants. In particular distributed teams potentially powerful for new organizational form with supported by powerful knowledge and shared understanding among teams [34].

#### 4.4.3. Stakeholders Identification

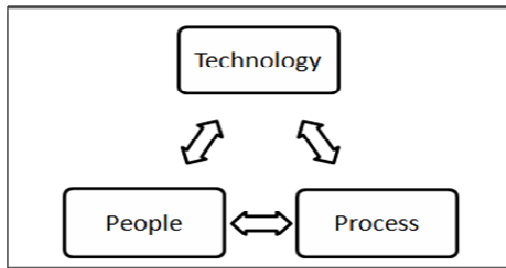
Project manager play an important role in the communication and co-ordination activities during the project development. The other human issue identified is “the good spirit and trust between the parties”. Human issues, such as trust, respect, good working relationships and appreciation, can reduce the communication fence and construct a good quality surroundings for communication [35].

## 5. Virtual team approach

At the moment, due to advance in information and communication technologies (ICT), construction firms get new opportunities to enhance activity of construction project from traditional co-located setting to virtual setting. Virtual team are significantly different from traditional team where is traditional team work next to others mean while virtual team work in different location area. Within of distributes working area, construction industries categorized by various challenges in term of working practise including non-collocated team members on site project, team members involvement in multiple project at the same time, temporary working practice, unstructured information and data, complexity involvement by different organisation and culture [38].

The ability of virtual team was implemented in various organisation in increase business activity such as in research and development, knowledge management, marketing, learning and training, manufacturing and others [36]. Nevertheless minor study focused on factor contributes to effective virtual team in Malaysian construction industries. Thus this is essential to implement virtual team approach according to successful of this team in others industry.

In particular these factors are vital element for project participant to achieve goal of the project. In order to achieve effective team communicate through virtual situation, previous study was identified the key element into three factors such as people, process and technology in serve as a good guideline for recover the entire life cycle of implementation of virtual team project [37]. This is illustrated in figure 2.



**Figure 2.** Model of Effective Virtual Team

### 5.1. *People*

Identification of leadership: Leadership considered high important to virtual team performance and one of significant challenges to organisation and critical factor for virtual team to success [38]. Team leaders can change a critical different of team performance and effectiveness. Within responsible in produce an effective communication tool in transferring a knowledge and information among team members [39]. Previous study trusts sharing information among team members will encourage team to work effectively and competitive [31]. As a leader, on time feedback, manage time table, resource sharing, education, training and motivation are responsibilities from leader to enable team with a positive influence [42]. Other than that, every team need a good team leader to solve the conflicts and make a decision plans and dividing the role because that can ensure that each member feels he is an integral part of the group and has a full opportunity to participate to provide a base for education, including the ability to listen, work in groups and solve problems [43].

Leadership issues are very important to construction industry, that is because construction industry involved by many different number of department and functional unit at beginning of project to assume a new personality [10]. Therefore, daily update status project and the project rule from team management can ensure each team members understand the responsibilities.

Effective project manager on planning and control core activities may help dispersed team members in creating a sense of connectedness with other team members and might increase the task interdependence [44]. The organisation can be organised effectively when have sufficient technical support in order to fulfil the requirement and values of senior project managers with the success of the project as the ultimate goal.

Trust: Trust is the key role in increasing level of confident among team members especially in virtual team environment [22]. There is important role in enable commitment and cohesion among teams members as well and generate new ideas to come out with a new creativity from different opinion [48]. Trust is created depend on performing of its team members with respect to each other's and not a social perception. The degree of trust among a team members create a responsibilities to completing a task on time, being proactive and have a good communication to understand and rely to each other's. Working in distributed area required trust because team likely involve by different area and background culture. Furthermore team members individually from different experience, skill, and age. The different condition may also produce high conflict and misunderstanding to success especially in virtual performance [49].

### 5.2. *Technology*

Communication planning: Technology mean as a mechanism or medium communication tool to coordinate activity, knowledge sharing and enhance interaction within team project [50]. The use of technology is capable to enhancing communication by transferring information via multi-channel and also will increase trust and level of performance. In large geographical area, distributed team is now possible to work through technology for coordinate team work for those working in different style of work. For those who working in different situation need a greater information exchange to coordinate and integrate the entire task to meet project goals. By using appropriate technology, communication problem associated lags and delay of communication can be reduce for example inability in understanding the language, different culture, and perception [51]. Within technology it will support clear communication and increase reputation of the project.

### 5.3. *Process*

Skill and training: That is essential to measure generic skill of individual and team to be effective went working in distributed area. Training is required to develop a specific skill and improve level of ICT awareness and maturity. Within the training programme it will enhance knowledge workers, motivation, talent, ability and self-confident in developed positive effect on job performance and associated with the introduction of tools and technology. Previous researchers argue that not all team members comfortable with technology but currently with differing workloads it will prevent each team from remaining equally on every piece of technology being used in the virtual environment. In fact every organisation should execute to provide each team members with equal training and it will remain to each member to learn and focus on generating project solution through virtual environment [52].

That was challenging to change virtual team over the life cycle of team. To point out that problem, additional training module need to develop to focus on issues related to conducting an effective virtual team meeting, problem solving and decision making. In addition, appropriate development training will be increase the value of professional and could enhance critical thinking to settle down the problem found in construction project [53].

### 5.4. *Advantages of virtual team*

Virtual team operate as an integrated team where is team members a connected in real time situation through electronic media whose team members are located in difference location. The potential advantages of virtual team are various, including enhancing project implementation, removal of geographical boundary, optimize competencies and integrate team partnership. Below are the reasons why virtual team are being popular in some organisation and table 3 shows the advantage and disadvantages of virtual team.

Reduce time and travel: a large number of expenses such as accommodation, travel and other daily allowance may be reduce or even no longer needed as a virtual team communicate through technology [54]. For instance IBM has estimate savings of \$50 million in travel and downtime costs through the use of virtual teams [55].

Train talented workers: Virtual team give new experience to recruit talented employee in this field. Now days worker unwilling to move because stressful and costly undertaking [56]. This perception is classifying one of the barriers to increasing company productivity. Company who undertaking this action will face maximization its human resource and easily to serve multiple teams on multi location.

Team collaboration: By using web based construction partnering project. All project requirement available anywhere and anytime to team members with a security and confidential access (project news, progress report, time sheets, pay requisitions, Email, schedule). As a result, according to project manager, the owner and constructor are very satisfied with the issues such as response time, follow up, communication problem and cooperation [57].

Effective monitoring and control: Introduce Virtual Construction Project Control System (VCPCS) to optimal construction duration and reduced the construction cost. As well as the entire construction step are performed effectively with no collision occurs during construction process, project was schedule according to the result of simulating the optimal construction plan obtained according to the results of balancing the relation of schedule, quality, cost and risk [58].

**Table 3.** Advantages and Disadvantage of Virtual Team

<b>Advantages</b>	<b>Disadvantages</b>
Reducing relocation time and costs, reduced travel costs	Challenges of project management are more related to the distance between team members than to their cultural or language differences
Greater productivity, shorter development times	Team members need special training and encouragement
Better team outcomes (quality, productivity, and satisfaction)	Cultural and functional diversity in virtual teams lead to differences in the members' thought processes. Develop trust among the members are

	challenging
Effective in making decisions and Sharing knowledge, experiences	Variety of practices (cultural and work process diversity) and employee mobility negatively impacted performance in virtual teams.
Integrating talent in newly industrialized. Facilitating transnational innovation processes	Challenges of determining the appropriate task technology fit

## 6. Discussion

This study examines the generic factor of virtual team in developing effective communication to practitioners in construction sector. With the nature of work, IBS construction project operate across national boundaries and create new challenges and occasion to accumulate teams to cooperate closely even though separated by different time and organisation barriers.

The virtual team, for example present a new way of organizing workforce to harness an information technology to overcome the barriers created by geographical distance and time. Furthermore the virtual team is a new avenue to overcome the limitation of communication inside IBS construction. This study aim to examining of limitation and developed better understanding on the problem arise during the implementation IBS project.

## Conclusion

This paper introduces the communication barriers around team members in the IBS construction project. The increasing complexity of technical and organizational in construction project required new development and use communication (ICT) to improve project delivery process. In this regard, base rapid development communication technology offer an opportunity for organisation to adopt virtual teams go beyond time, national culture and cross the boundaries.

Furthermore, implementing virtual team is based on people, process and technology. Hence, these approaches offer many advantages to organisation in determined demanding on project work and also present several challenges and pitfalls. Moreover,

virtual teamwork becomes increasingly admired in various organizations with many attractive opportunities. Due to these opportunities, virtual team is an effective approach for the project cross-functional or cross boundary in increase value creation to overcome the issues that have been highlighted.

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