



THE IMPERATIVENESS OF INFORMATION MANAGEMENT ON HOUSING PROJECT DELIVERY

¹. Mbazor, David Ngwoke and Adebayo, Adedayo Michael ²

¹ School of Environmental Technology, Department of Estate Management

Federal University of Technology P.M.B 704 Akure, Nigeria.

² School of Environmental Technology, Department of Estate Management

Federal University of Technology P.M.B 704 Akure, Nigeria.

¹. dnbazor@futa.edu.ng, ². maadebayo@futa.edu.ng

Abstract

Building Industry from ages is highly dependent on Information. It is the key to effective and efficient delivery of projects to the clients. This is primarily due to the segregation of the industry into functional area with different people of varying skills. However, majority of construction business processes up till today are still heavily dependent upon traditional means of communication such as meetings, face –to- face, sign language and the exchange of paper documents in form of drawings, specifications, schedules and instructions. Information and Communication Technologies (ICT) will provide construction firms with new opportunities for enhancing communication, data collection and manipulation, collaboration etc. The study involves a survey of 50 construction stakeholders comprising project managers, clients, artisans, contractors etc. in ten (10) different construction sites in Abuja Nigeria. Descriptive statistics of percentages, frequencies and likert scale were adopted in the analysis of data collected. The study reveals that construction industry is one of the most information-dependent Organisations, characterised by diverse forms of information such as working drawings, photos, cost analysis chart, budget reports sheet, construction risk analysis sheet, etc. which need to be efficiently transmitted from one point to another in order to facilitate and aid construction activities. It further reveals that the non application of modern ICT tool in the study area is responsible to delay, cost overrun and reworks of most projects. The study recommends that every construction Organisation should endeavour to establish information management policy, through the application of modern ICT tools within the Organisation in order to effectively manage information flow.

Key Words: Communication, Information Management, Project Management, Construction Organisation and ICT

1.0 INTRODUCTION

These days, Organisations such as the housing sector and the construction industry generally are information-driven, making information management an important aspect of the overall project success. Information is central for strategic planning, management, control, and daily operations (Curtis & Cobham, 2000). Activities in building or construction Organisation are segregated into functional areas which are handled by people with different skills and they function independently without regards to its effect on the overall performance of the project. This is due to the absence of efficient 'integrated management information system' such as EDM etc. to support decision making and information exchange among the project team.

Information is described as the product of the appropriate understanding and interpretation of Data. It is the essential means through which emotions, knowledge, skill, judgement, expression and decisions held by individuals or group of individuals is expressed, shared, communicated and translated with others (Davenport and Marchand, 2000). In the view of Hicks et al (2006) Information Management (IM) is defined from the point of view of an organisational to consist of the activities that support the information lifecycle from point of formation, representation and maintenance through to transfer, communication and reuse. Hence, Evgeniou and Cartwright (2005) noted that an information intelligent organisation is one which understands the value of information and has the capacity to successfully investigate, assemble, analyse, use and reuse all the available forms of information products required for any of its operational tasks.

Lahdenpera (1995) and Love et al (1998) observed that, "the interfaces that exist between functional disciplines have become a potential barrier to efficient and effective information management and proper co-ordination of construction projects activities". Consequently, information generation, analysis and control, in building project activities become unplanned resulting to reworking, redesigning, poor communication and finally information mishaps which culminate to quality failure, time and cost overruns. Effective information management through the application of Information and Communication Technology (ICT) tools will facilitate collaboration and efficiency in construction Organisations as a whole.

2.0 LITERATURE REVIEW

Information management (IM) in general English dictionary and thesaurus is described as "the collection and management of information from one or more sources and the distribution of that information to one or more audiences". A construction project requires substantial effort, time, and huge capital outlay. Information management according to Chassiakos (2001) provides the means for improved project construction, coordination of individual efforts, time management, cost reduction and successful delivery.

According to Bowden et al (2005), information and communication technologies (IT) are providing construction firms with new opportunities for enhancing communication, data collection and manipulation, collaboration and information management processes. However, observation shows that majority of construction business processes up till today are still heavily dependent upon traditional means of communication such as meetings, face –to- face, sign language and the exchange of paper documents in form of drawings, specifications, schedules and instructions. This, in the words of Baldwin et al (1999) is due to "a number of historical, industrial and market forces that perpetuate the industry's culture, thereby affecting the extent of IT adoption in day-to-day construction business processes".

“Competitive pressures and client requirements” according to Hannus et al (1999), are beginning to diminish the original culture of construction information management, forcing construction Organisations to find efficiencies in modern processes, especially those pertaining to how project information is passed, gathered and managed. To this extent, Deng et al (2001) observed that “the advent of effective information management aids in integrating partnered supply chains within the construction industry” and as such enhances the effectiveness of information interchange and strong relationships between project stakeholders.

2.1 INFORMATION MANAGEMENT APPROACH

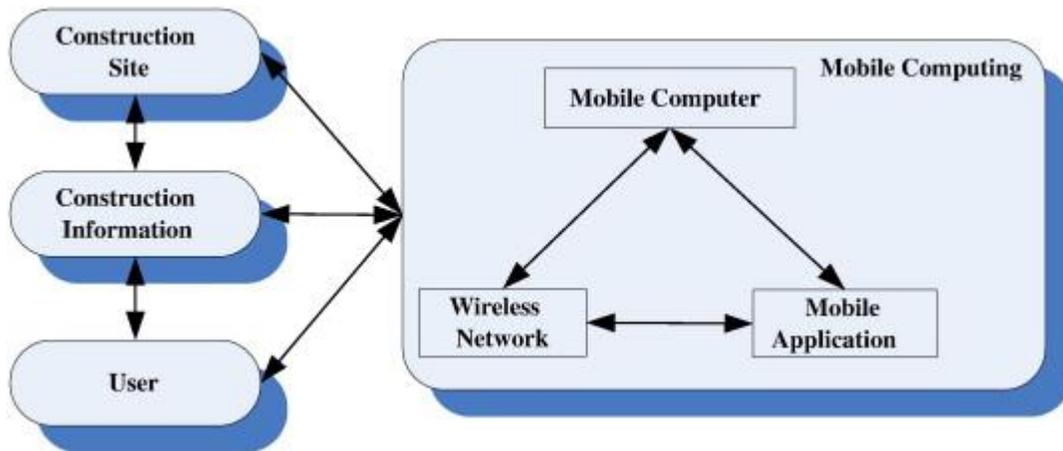
Information Management requires the combination of strategies, tools, processes and skills within a particular organisation to manage all forms of available , both recorded and unrecorded information through its complete lifecycle from formation until removal and supported by necessary technological and administrative infrastructures (Boiko, 2002; Tyrvaïnen et al, 2002; Nordheim and Paivarinta, 2004; Munkvold et al, 2006; HP, 2007). Numerous technologies are in existence which enables this approach; however, very critical to the success of this approach is emphasis on corporate wide strategies and policies controlling the use and application of the appropriate technology (Paivarinta & Munkvold, 2005). The approach to IM which is holistic are made up of four important components essential to ensure that the approach is appropriate and can be effectively implemented in order to support the organisation (Marchand, 2000; Bridges, 2007). The components includes: (i) The Content Model approach which denotes the nature of the content, its lifecycle, structure, attributes, business applications and its suitability for the organisation. (ii) Metadata and Taxonomy approach: This is based on an analysis of the organisation, its distinct operations, culture, partners and supply chain based on their interaction with information through time element. (iii) Technological needs approach which facilitates the implementation of the predefined strategy. (iv) Implementation and Change Management approach to manage the transition and support the implementation of the strategy.

2.2 CONSTRUCTION INFORMATION MANAGEMENT AND ICT

Construction industries are information intensive environments (Yuan Chen, 2008). Construction workers require large volume of information of various sorts ranging from design drawings, specifications etc. to facilitate their works. The emergence of Information Technology (IT) such as project intranet and extranet has the capability to improve and facilitate information management on construction sites to off-site offices and so on.

Given the nature of construction information, the efficiency of information management becomes crucial to the construction industry and as such has been recognised as an important competitive advantage to construction companies. Yuan (2008) identified the following as information transfer media: Fax, Telephone, Email, Intra/Extranet etc. Construction information, according to Dawood et al (2002) has “greatly benefited from the advancement in Information and Communication Technology (ICT)”. Information passage in a construction organisation is as shown in the figure below.

Fig.1 showing Construction Information Management on a construction site



Adopted from Science direct.com (2015)

2.3 NATURE OF INFORMATION HANDLING ON CONSTRUCTION ORGANISATION

Activities in the construction Organisation passes through different stages at different times in the construction lifecycle, and it starts from project conceptualisation through project design to project closure. At the design stage, the inputs of client requirements such as shape, size etc. is translated into information for actual construction. To satisfy client's needs and ensure that the design is achievable, the design stage must have information about the construction, operation and maintenance of the project (Kamara et al., 1996). Therefore, the design stage must be integrated with information about construction, use and maintenance.

In the construction industry, production is outdoors and far from the offices of the designers, which has a great impact on the success of design and construction. This has led to the difficulty of information communication between design teams and construction contractors, and the difficulty of project information access by project participants on construction work sites. Integrated design and construction require effective and efficient communication between the work point and the design team. Waiting for design information is said to be the principal cause of delays in site work. Elvin, (2003) opined that "Until when this task-level bottleneck of information communication is resolved can the benefits of applying integrated design and construction in the construction industry be achieved at a larger scale". Regrettably, most construction industry are yet to find suitable solutions for the problems of information and communication exchange in their Organisation bearing in mind that large amount of information ranging from design drawings to personal records are useful in supporting their work and decision making at various levels of construction work.

Other issues in relation to information management in construction Organisation is observed by Bowden et al (2004) to be that the type of information construction workers receive and transfer

are mostly paper based documents, such as drawings, data forms, correspondences, progress information and specifications. The weakness of these paper-based files and documents has remained the main noticeable constraint in construction information and communication exchange. Singhvi and Terk (2003) observed that “Ineffective construction site information and communication can result in construction personnel overlooking important issues that require a quick response and often cause on-site decisions to be deferred”. This situation has most often led to fundamental construction errors being committed such as mistaken 6 for 8 due to illegible copy of working drawings.

Zhang and Dimby (2006) noted that the fragmented nature of construction industry and the unstructured nature of data involved create a culture that depends on face to face communication. This is dangerous to site operations because information stored on the head is not secure as human being has the tendency to forget or even die. Therefore, good and efficient communication of information through a reliable technology such as computer technology is vital for successful delivery of project goals.

Also, Miah et al., (1998) stated that “coordination of activities and management of various operations on a construction site raises numerous questions and interactions among project participants, which need to be resolved quickly and efficiently to avoid time/cost overruns, rework, and material wastes”. Hence, a well-coordinated management information mechanism becomes an indispensable factor in information management in a construction Organisation.

Notwithstanding the great importance associated to the use of IT in today’s business world, the technology is faced with challenges as pointed by Peansupap and Walker (2005) who noted that “there is limited budget commitment to IT facilities in Organisations” as such the prevalence of substandard practices in the construction industry. It is based on this that Craig and Sommerville (2006) posited that “there is slow implementation of IT in construction industry”. This is basically due to the capital intensive nature of modern ICT facilities and lack of will power to adopt the technology by the contractors.

2.3 IMPACT OF ICT ON CONSTRUCTION PROJECT DELIVERY

We are living in information driven age where information is a tool for survival of businesses. No matter the size of a construction Organisation, activities will involve managing different forms of information to ensure the smooth running of the business and to keep track of business progress. The principles of construction company business according to Harris and McCaffer (2006) “is not different from that of any other type of company”. Here, they stated that processes such as design, tendering, construction, research, development etc. are the forms of businesses traded in construction business environment. These processes need efficient and effective communication to fast track quick decision making and strategic planning in order to realise the overall business objectives of the client.

The absence of or inefficient information management system to accelerate communication in the construction industry has impacted negatively to the success rate of most construction organisations, as such situation results which slow down decision making process and strategic planning, and also engenders misunderstanding of instructions , non-collaboration among teams, lack of integration and unity of purpose, mismanagement of resources. All these may lead to delay in completion, cost overrun, compromise in quality and sometimes results to rework.

Josephson and Hamarlund (1999) noted that “quality failures occur in construction as a result of inefficient decision making occasioned by poor information handling”.

On the other hand, the application of IT in the management of information flow in construction industry has the potentiality of impacting positively to the construction business environment. The emergence of new Information Technology, such as mobile computing and mobile sensors, has great potential to enhance information management on construction sites.

3.0 METHODOLOGY

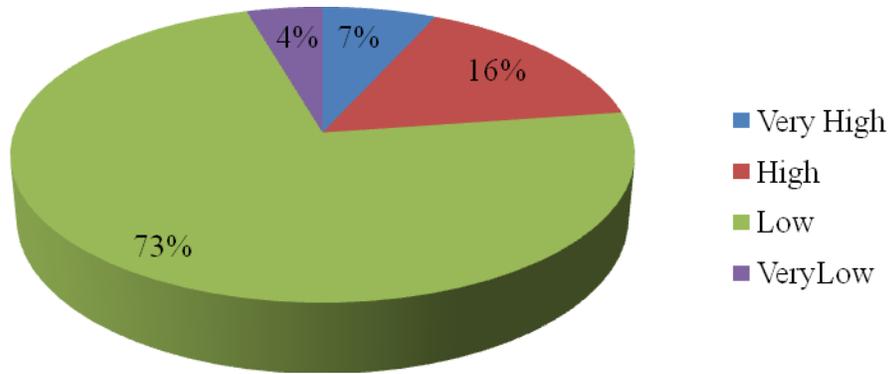
The study involves structured questionnaire survey of a set of 50 construction stakeholders comprising project managers, clients, labourers, contractors and site administrative staff in ten (10) different selected construction sites in Abuja Nigeria. This population are presented with a list of indicators associated with information management on construction site. The choice of Abuja for the study was informed by the volume of construction industries undertaking different construction projects in the city. Between 2009 when Nigeria effectively returned to democratic governance till date, several projects worth billions of naira have been initiated, some are ongoing while others are completed. The population was selected using purposive sampling. This sampling technique is used where there is no data base of the exact number of the characteristics required by a study. This method is also widely used in construction industry’s research (Dada, 2013 and Li *et al.* 2005). Project managers, contractors, clients, labourers and site administrative staff were therefore purposely selected from the 10 different construction sites based on the knowledge of their involvement in construction information passage.

The interview themes were based on two focal areas, failure of construction stakeholders to adopt information management process to address quality construction projects and best approach and criteria for the adoption of the system to ensure effective information management on construction project. Prior to the field work, extensive literature search was made on the research themes and factors generated collectively and individually formed the structured interview questions.

4.0 RESULTS AND DISCUSSIONS

The 50 respondents replied to the questions designed to access the state of non-application of Information Management on construction project Organisation in Nigeria using indicators generated from literature. The indicators were ranked on three (3) point scale with one (1) being the least and three (3) being the highest except on the general level of ICT application on construction organisation which was analysed using percentage.

Chart 1: Level of ICT Application in a Construction Organization



Source: Field Survey, 2015

From Chart 1, 73% of the respondents agreed that the level of ICT application in construction organizational operation is low. Only 16% believed that the level of ICT application in organizational operation is very high. This suggests that ICT application in construction projects remains as a main issue that needs to be addressed in order to successfully deliver on a project.

Table 1: Problems associated with non-application of Information and communication technology

Problems	(3) Very Important	(2) Important	(1) Not Very Important	Relative Importance Index	Rank
Non collaboration among team	9 (18)	29 (58)	12 (24)	2.00	8
Project delay	36 (72)	11 (22)	3 (6)	2.66	2
Poor quality Product	34 (68)	9 (18)	7 (14)	2.54	3
Engenders misunderstanding of instruction	22 (44)	16 (32)	12 (24)	2.20	7
Slow down decision making process	31 (62)	11 (22)	8 (16)	2.46	5
Slow down strategic planning	28 (56)	13 (26)	9 (18)	2.38	6
Project Cost escalation	41 (82)	7 (14)	2 (4)	2.78	1

Rework	32 (64)	11 (22)	7 (14)	2.50	4
--------	---------	---------	--------	------	---

Source: Field Survey, 2015

Table 1: Shows the major problems associated with non-application of information and communication technology (ICT) by construction project stakeholders in Nigeria. Project cost escalation was the most important of the problem highlighted. This was evident from its relative importance index of 2.78, while project delay ranked second with the relative importance index of 2.66. Interestingly, no results showed the relative importance index of less than 2.0. This means that the respondents were not in dispute as to the importance of all the problems given.

Table 2: Effect of Poor Information Management on project delivery

Effect	Very important	Important	Not very important	Relative important index
Time and cost overrun	39	10	1	2.76
Reworking	34	12	4	2.62
Quality failure	31	10	9	2.60
Redesigning	36	10	3	2.44

Source: Field Survey, 2014

Table 2 presents respondents' views on the most noticeable effect of poor information management on construction project delivery. Time and cost overrun was the most noticeable effect of poor information management on construction Organisation. This was evident from its mean score of 2.76. This was followed by reworking with the mean score of 2.62. Redesigning is least popular with the mean score of 2.44, although it remains as one of the options.

Table 3: Benefits of Effective Information Management

Benefits	Mean Score
Collaboration among the stakeholders	2.42
Good time management	2.64
Cost reduction	2.50
Successful delivery (quality)	2.68

Source: Field Survey, 2015

As shown in Table 2, the main advantage of effective information management from the respondents' point of view was that it was considered as the main tool to achieving successful delivery of project. The table also indicates other advantages, which are: collaboration among the stakeholders, good time management and cost reduction. These are the advantages that scored higher rating in the survey as compared to major problems associated with non-application of information and communication technology by construction project stakeholders in Nigeria.

5.0 CONCLUSION/RECOMMENDATION

From the reviewed literature, it is safe to conclude that construction industry is one of the most information-dependent Organisations, characterised by diverse forms of information such as working drawings, photos, cost analysis chart, budget reports sheet, construction risk analysis sheet, contract formation documents, construction planning schedules, work time sheet etc. These are tools used in the execution of project and need to be efficiently transmitted from one point to another in order to facilitate and aid construction activities.

The size of information generated, manipulated and exchanged during a project lifecycle is huge notwithstanding the size of the industry. Efficient and effective information that is timely and accurate is required for and from all project teams and indeed all stakeholders as it is based on such that decisions are made and work progress achieved.

The distance between construction organisation's office and construction site are usually far given that majority of the operations are out-door and as such could result to un-coordinated communication within the industry. Inadequate, inconsistent, inefficient and insufficient information coupled with the poor management methods and procedures among the project team have been identified to be some of the major and root causes of delay in construction project delivery.

Despite the inestimable advantages associated to ICT in information management in today's business world, many construction organisations are yet to embrace the technology fully. They still depend on the undefined and uncoordinated traditional means of communication such as face to face, body language, paper documents in form of drawings, schedules etc. in their day to day operations. This has resulted to mis-information, mistakes, error, mis-interpretation and a whole lot of problems which culminate to delay and consequently to cost escalation and sometimes poor quality product.

In order to entrench the culture of effective collaboration and integration of work, process and people within a construction industry, there is need to change from the traditional form of information management such as paper based information exchange, face to face meeting to the modern electronic methods of communication and information exchange such as project intranet and extranet. "Centralised information systems that are accessible to all party in a construction project site are powerful tools in the quest to improving efficiency and to enhance the flow of information within the construction industry" (Aouad et. al. 1995). This sort of systems removes the need for duplication of data and hence errors are avoided leading to higher productivity and effective performance in construction business.

The construction Organisation can overcome the current challenges of information management to become more clients oriented and highly competitive in the dynamic economic environment by adopting ICT as an aspect of construction process. To this end therefore, every construction organisation should endeavour to establish information management policy, through the application of modern ICT tools within the organisation to manage information flow. Maintaining open, regular and accurate channels of communication with all levels of project team and stakeholders is vital to ensuring the smooth flow of information in form of instruction among the project team and sufficient warning of risks and changes are dictated and resolved in time.

REFERENCES:

- Aouad, G., Brandon, P., Brown, F., Child, T., Cooper, G., et al. 1995, The conceptual modelling of construction management information. *Automation in Construction*, 3, 267–282.
- Boiko B (2002). *Content Management Bible*, Hungry Minds, New York, USA.
- Bridges J D (2007). “Taking ECM from concept to reality”, *Information Management*, Vol.41 No. 6, P 30.
- A.N Baldwin, A. Thorpe and C. Carter 1999, The use of electronic information exchange on construction alliance projects. *Automation in Construction*, pp. 651–662
- A.P. Chassiakos 2001, *Civil and Structural Engineering Computing: School of Engineering, University of Durham, United Kingdom*
- Bowden, S., A. Dorr, T. Thorpe and C. Anumba 2005, Mobile ICT support for construction process improvement. *Automation in Construction*, 15, pp. 664–676.
- Bowden, S., Dorr, A., Thorpe, A., and Anumba, C. 2004, “Mapping site processes for the introduction of mobile IT”. *Proceedings of the 5th European Conference on Product and Process Modelling in the Building and Construction Industry*, A. Dikbas and R. Scherer, eds., Istanbul, Turkey.
- C. Nigel and J. Sommerville 2006, “Information Management systems on construction projects Records Management “, *Journal* vol. 16 ISS: 3, pp 157 – 173 available at www.emeraldinsight.com/journals.htm. Accessed on 21/11/2011
- G. Curtis and D. Cobham 2000, *Business information systems: Analysis, design and practice*, (4th ed.), Addison-Wesley, Reading, MA.
- Dawood, N., Akinsola, A., and hobbs, B. 2002. Development of automated communication of system for managing site information using internet technology. *Automation in Construction*, 11(5), pp. 557-572.
- Elvin, G. 2003, “Tablet and wearable computers for integrated design and construction”, *American Society of Civil Engineers Construction Research Congress*, Honolulu, March 19, 2003
- Evgeniou T and Cartwright P, (2005). “Barriers to Information Management”. *European Management Journal*, Vol.23 No.3, pp 293-299.
- Hewlett Packard, (2007). *Managing Data as a Corporate Asset: Three action steps towards successful data governance*, white paper, available at www.hp.com last accessed 15/11/2015
- Hicks B.J, Culley S.J, McMahon C.A (2006). “A study of issues relating to Information Management across engineering SMEs”, *International Journal of Information Management*, Vol.26, pp 267 -289
- J.Zhang and T.E EL-Diraby 2006, “A semantic frame works to support corporate memory management in building construction”. *Automation in construction*, Vol. 15(4), 504-521

- Kamara, J. M., Anumba, C. J., and Evbuomwan, N. F. O. 1996, Integration of design & construction: A review of existing approaches. School of Science and Technology, 1996.96/2.
- Marchand D, (2000). *Competing with information - A Manager's Guide to Creating Business Value with Information Content* Wiley, UK
- M. Hannus, A. Watson, B. Luiten, M. Deguine, G. Sauce and T. Van Rijn 1999, "ICT tools for improving the competitiveness of the LSE Industry". *Journal of Engineering, Construction and Architectural Management*, 6, pp. 30–37.
- Miah, T., Carter, C., Thorpe, A., Baldwin, A., and Ashby, S. 1998, "Wearable computers - an application of BT's mobile video system for the construction industry". *BT Technology Journal*, 16(1), pp. 191-199.
- Munkvold B E, Paivarinta T, Hodne K A, Stangeland E, (2006). "Contemporary Issues of enterprise content management", *Scandinavian Journal of information systems*, Vol.18 No. 2, pp 69-100.
- Nordheim S, Paivarinta T, (2004). "Customisation of Enterprise content management systems: an exploratory case study", *Proceedings of 37th International conference on system sciences*, Hawaii
- P.Lahdenpera 1995, *Re-organising the Building Process – The Holistic A approach*, VTT Publications, Technical Research Centre of Finland, Espo Finland.
- Paivarinta T, Munkvold B.E, (2005). "Enterprise Content Management: An Integrated Perspective on Information Management", *Proceedings of 38th International conference on system sciences*, Hawaii, p.9
- P.E.Josephson and Y.Hamarlund 1999, *The Causes and Costs of Defects in Construction. A study of Seven Building Projects: Automation in Construction* pp. 642 -648
- Singhvi, V., and Terk, M. 2003, "Prophet: a contextual information system framework". *Proceedings of the CIB W78's 20th International Conference on Construction IT, Construction IT Bridging the Distance*, CIB Report 284, R. Amor, ed., Waiheke Island, New Zealand.
- Tyrvaainen P, Salminen A, Paivarinta T, (2002). "Introduction to the Enterprise content Management Mini-track", *Proceedings of 36th International conference on System Sciences, (HICSS)*, Hawaii, P. 104
- V. Peansupap and D. Walker 2005, *Exploratory factors influencing information and communication technology diffusion and adoption within Australian construction organizations: a micro analysis*. *Construction Innovation*, 5, pp. 135–157.
- Yuan Chen, John M. Kamara 2008, *The Mechanisms of Information Communication on Construction Sites* Newcastle University.
- Z.M. Deng, H. Li, C.M. Tam, Q.P. Shen and P.E.D. Love (2001), *An application of internet-based project management system*. *Automation in Construction*, 10, pp. 239–246.