

Adoption of Web-Based Project Management System for Construction Project Delivery

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Abstract

Background: Web-based Project Management Systems (WPMS) are designed to improve collaborative working environments by speeding up communications, information transfer and coordination. The growth in the use of web-based applications to improve processes has helped several industries migrate to newer ways of achieving objectives, but this is yet prevalent in the Nigerian construction sector. **Aim:** This study investigates awareness of WPMS amongst construction professionals and its perceived impact on project delivery. **Methods:** This is achieved by reviewing literature on features and benefits of WPMS for project delivery. Semi-structured interviews were conducted on 15 registered professionals and questionnaires distributed to 97 others to evaluate awareness and perceptions on WPMS benefits. 76 copies of questionnaires was retrieved and used for analysis representing 78% response rate. **Results:** Literature revealed 13 shortcomings and highlighted 17 potential benefits of WPMS. Interview respondents (80%) revealed little are known about WPMS amongst professionals in Nigeria but agree it will enhance project delivery by facilitating new collaboration areas, improve communication, coordination and management. Another 27% insist the shortcomings are drawbacks to adoption of WPMS but all (100%) interviewed have positive attitude towards WPMS adoption. WPMS is perceived to impact on project delivery with enhancement of communication and collaboration activities having mean score of 4.22 while cost reduction & time saving activities has mean score of 4.01. It is concluded that embracing new project management methods through use of WPMS will enhance project delivery. It is therefore recommended that increasing awareness of WPMS will expose its potential benefits and its impact on project delivery.

Keywords: Collaboration, Construction, Project Delivery, Project Management Methods, Web-based Project Management Systems.

1. Introduction

Two primary success concepts exist when talking about projects: project success and project management success (Radujkovic and Sjekavica, 2017). The two concepts, despite being different from each other has difficult lines of distinction because of the many models of both the project success and its management (Kenzner, 2017). The aim of project management as described by Ko (2011) is to proficiently achieve predefined goals that adds value to processes using available resources. It can therefore be inferred that successful project managements' primary focus is to achieve projects in the most efficient and effective way. However, construction project management is still affected by issues such as the use of unsuitable tools for communication, obsolete methods for coordination and inappropriate systems for management (Bhzad, 2012; Kenzner, 2017; Oliva and Kotabe, 2019). The construction industry has recognised the need to increase the effectiveness of project managers in the management of projects by using systems that can exchange large volumes of documentations in real time and at very low cost (Deng, Tam, Shen and Love, 2001). Similarly there is the recurrent need to enhance project management processes through the application of web-based solutions and tools (Alreemy, Chang and Wills, 2016; Deng *et al.*, 2001; Oliva and Kotabe, 2019).

The simplest way of describing the delivery process in construction is as described by Ashworth (2008) consisting of inception, design, construction and handover. During these stages, professionals in the built environment employ different management functions and skill to ensure prompt delivery. Construction project success is influenced by a number of significant elements such as project management actions and procedures (Chan, Scot and Chan, 2004). These actions comprises communication systems, control mechanisms, feedback capabilities, planning efforts, and overall managerial actions (Chan *et al.*, 2004; Kezner, 2017). Communication systems have evolved over the years (Akinradewo, Ojo and Oyefusi, 2018) and has been pivotal to the development of several industries (Oyediran and Odusami, 2005). More recently web-based communication systems have helped bridge the gap of diverse location factors amongst project teams (Alreemy *et al.*, 2016; Faris, Hutchinson and Gaterell, 2019). Web-based services are categorized into four (Wamelink *et al.*, 2002): electronic marketplaces, information portals, enterprise portals, and web-based management systems. These systems which are products of the proliferation of internet based technologies have been reported to be employed by project teams for communication, information exchange and managing time and cost problems (Alshawhi and Ingirige, 2003). Communications and Project Management Systems (CPMS) like mobile networks and Web-based Project Management Systems (WPMS) have assisted project managers to achieve project objectives such as cost, time, scope and quality (Bhzad, 2012; Radujkovic and Sjekavica, 2017).

Contemporary developments in the field of Information Technology (IT) and advent of new concepts (Bhzad and Sanad, 2010, Alreemy *et al.*, 2016) are a pivotal reason for prominence of WPMS. Obradovic *et al.* (2014) observed that more sophisticated IT tools help Project Managers to effectively capture information in all meridians throughout the world. Hence, employing WPMS to manage construction projects would help Project Managers harness the turnout of project management functions and ultimately improve construction project delivery (Sanchez, Sanz, Latorre, and Vidaurre, 2019). The emergence of web-based technologies and applications to human businesses and daily activities has helped several industries migrate from traditional ways of achieving objectives because of how they improve processes (Oyediran and Odusami, 2005). Also, taking advantage of technological tools available by different professionals have advanced their individual processes and profession (Bhzad and Sanad, 2010; Li, 1996; Oliva & Kotabe, 2019; Pollack-Johnson *et al.*, 1998). This study examines WPMS awareness amongst built environment professionals and evaluates the impact of employing WPMS for construction project management.

2. Related Works

WPMS are applications that concentrate on the effective implementation of project management methods (Izang, Ihesiulo, Ofuru and Okafor, 2016). The system uses wireless, satellite, internet or mobile tools and networks to function therefore obliterating paper trails (Bhzad and Sanad, 2012). WPMS brings project participants together on a central project portal with access to real time project information, allows speedy document sharing, and collaboration for planning and decision making (Izang *et al.*, 2016; Zou and Roslan, 2005). Collaboration in virtual environments however requires intensive motivation of the team members, extensive support by their team leader and appropriate technology (Davidekova and Hvorecky, 2016). Management of construction projects around the world now utilize collaborative tools because of the complex and fragmented nature of construction together with the dispersed nature of construction professionals around the globe working on the same construction project (Faris *et al.*, 2019; Oraee, Hosseini, Edwards, Li, Papadonikolaki and Cao, 2019). Web-based solutions utilize machine languages that is web browser supported such as HTML or ASP so that access through a client's web browser is easy and possible (Rouse, 2019).

2.1 Basic Features of WPMS

In essence, a web-based system utilizes software that collects information employed to create programmes and processes (Izang *et al.*, 2016; Rouse, 2019) that is used to manage different aspects of a project from inception to completion. Zou and Roslan, (2005) citing several authors (Becerik, 2004; Doyle, 2001; Sifri, 2000), documented tools that form the content of WPMS to include the following:

- i. Document management tool: creates and customizes file cabinets, drawers and documents specifically to members of the project while creating security features to restrict or grant access.
- ii. Workflow management tool: the tool enables definition of workflow process, ordering of sequence tasks, document distribution, tracking tasks, giving direction to the teams, tracking time and updating schedules within a workspace.
- iii. Collaborative tools: this tool gives team members the ability to virtually meet when they are geographical apart and collaborate without holding face to face meetings or conferences.
- iv. Organizational tool: this tool organizes project information and documents. It has features such as contact list, news board, special links and keywords to find files.
- v. Data exporting and reporting tools: conversion of project information from one format to another is made possible using the data exporting tool. This identifies the compatibility requirements and converts data to formats accessible to all participants. Equally the reporting manager allows for the efficient creation of reports on different activities such as: progress made, events, news and documents preparations.
- vi. Maintenance tool: this is the system administrators' workstation to give necessary access permissions at different levels and to define control parameters. It also serves as the maintenance tool to add and remove participants on the project from the WPMS site. The administrator regulates hard disk space, archive files, set up system parameters, and maintain databases.

The tools provide platforms that have multiple user functions to improve processes of project management. Skibniewski and Zhang, (2005) identified three choices available in current markets for companies to implement WPMS as: to create an in-house system; to buy customized vendor software and install in the server of the company or; to subscribe to an application service provider (ASP).

2.2 Identified Benefits of WPMS

Literature documented significant benefits of WPMS to project delivery. Most significant of the reports categorised the benefits of WPMS into four main areas: Cost and time reduction; communications and collaboration improvement; productivity and partnership enhancement and; e-commerce and customer relations support (Izang *et al.*, 2016; Nitithamyong and Skibniewski, 2004; Orzohon *et al.*, 2014). Other identified advantages include: quick access to early update of documents thereby reducing project delays, cutting down number of visits and traveling time to site meetings, reducing drawings mistakes, reducing incidence of disputes thereby saving wasted time and cost on disputes, quick information and data sharing and exchange capacity, routine and repetitive activities can be automated and paper trails in hard copy reports are eliminated (Alshawi and Ingrige, 2003; Poriya, Shah and Pitroda, 2020; Stewart *et al.*, 2004; Wamelink *et al.*, 2002).

In other related research, benefits of WPMS which enhances project management methods were identified as: a) improved productivity during physical meetings between project professionals on the same project because information required to make effective decisions are on time and have been adequately reviewed by participants prior to the meeting; b) project delays become reduced due to the real time flow of information; c) brings awareness of project matters to all parties and increases response rate of participants to issues, and; d) access to project information and retrieval is made easier (Bhzad and Sanad, 2010 citing Wamelink *et al.*, 2002 and; Bowden, 2005). Furthermore, such systems has changed the way construction professionals traditionally manage projects because it improves communication on projects, enhances documentation and supports effective control (Oraee *et al.*, 2019). Bhzad and Sanad, (2010) also highlighted that WPMS usage allow project participants to exchange project information and communicate in a way that is efficient, fast and saves cost. Similarly, Ozorhon *et al.* (2014) opines that Web-based database systems is useful for organisational knowledge management which enhances better decision making. The system increases Operational Learning (OL) based on the capture of data, conversation to knowledge, storage and retrieval of knowledge when required. Proper data base, document and knowledge management is averred to enhance project management processes thereby improving project delivery (Poriya *et al.*, 2020). Finally, the objective of using ICT to enhance processes is primarily to reduce cost of processes, improve efficiency and productivity, shorten completion times for all activities and provide improved customer services (Cartlidge, 2011; Poriya *et al.*, 2020).

2.3 Shortcomings and Constraints to the use of WPMS

The document management tool of WPMS improves project management processes tremendously (Rouse, 2019) hence, when not employed, it becomes a primary shortcoming because two-thirds of construction issues still emanate from poor coordination and inefficient system of information communication (Abdul Rahman and Gamil, 2019; Poriya *et al.*, 2020). Other identified shortcomings of web-based systems from literature were described more as limitations that require attention. For instance, Bhzad and Sanad (2010) perceived probable limitation to include that businesses may incur extra direct and indirect cost because learning how to properly use IT is demanding and staff training will be required. In addition web-based systems have inclinations to run slower than intranet supported systems (Rouse, 2019) depending on the available uplink network in the area, especially in developing countries.

Cartlidge (2011) further posited that the main constraint of using e-technologies are high setting up costs, reduction in inter-personal meetings and staff training. Other constraints identified by Bhzad and Sanad (2010) includes that staff adaptation to new ways of doing things is difficult; system reliability and security issues exists; applying IT to processes has its own drawbacks with effects that are sometimes indirect; the accruable benefits are often short-lived and they cannot be adequately measured in financial terms as tangible profits; IT is considered a tool that can be rightly used or otherwise because it requires human operation to function, its reliability is dependent on the operators expertise and knowledge which can sometimes be time consuming and susceptible to errors. In addition, the use of different tools by collaborating professionals on a project sometimes constitute a constraint to the use of web-based systems (Lai, Deng and Cheng, 2019) because in many cases, data exchange in large formats from different professionals have compatibility issues.

In a study of the use of WPMS carried out in Australia, Zou and Roslan (2005) posited that a large number of construction firms do not use WPMS. This is primarily because they do not consider its use as beneficial, and the constraints of their low financial capacity, relatively small turnover and inadequate IT skills to run such a system, all discourages its use. With the recent digital transformation (Aja and Chigozie-Okum, 2019) and informatisation in Nigeria, it is believed that the construction industry will embrace WPMS use for construction project management to enhance project delivery.

2.4 Impact of WPMS on Project Delivery

A construction project like any other product is conceived and delivered through processes and stages with successes through the stages sacrosanct. Several studies (Abdul Rahman and Gamil, 2019; Akinradewo *et al.*, 2018; Izang *et al.*, 2016; Obradovic *et al.*, 2014) have identified communication as part of the management actions that affect success of a construction project. Similarly Wang, Han, De Vreies and Zuo (2016) averred that inefficient communication is the most critical risk element on construction projects. Davidson and Moshini (1990) posited that construction cost can possibly be reduced by 25% through the proficient exchange of information and knowledge between project participants. Therefore, it is vital to enhance communication for successful project management (Poriya *et al.*, 2020). Construction professionals require different types of information during project delivery which includes; project reports, construction material management, construction equipment management, construction cost management, work schedules, method related items, site record keeping, submittals, construction health and safety, quality assurance and control (Garza and Howitt, 1998). Therefore, the amount of information and documentation generated and exchanged during the construction process is massive, even on small projects (Chassiakos and Sakellaropoulos, 2008; Poriya *et al.*, 2020). The information from these activities cannot be managed efficiently using paper trail documentation and face-to-face communication and information management systems because of its shortcomings in fulfilling project objectives (Yang *et al.*, 2007). One of the shortcomings is that it provides limited access to information which is considered as one of the key barriers to project management success (Pena-Mora *et al.*, 2009; Poriya *et al.*, 2020; Vadhavkar and Pena-Mora, 2002). It is anticipated by a number of researchers that WPMS will replace traditional project management methods (Becerik, 2005; Zou and Roslan, 2005). Several reasons support this claim including increased competitive pressures, expectations of revenue growth, the ability to compete globally, and the desire to reengineer the business to respond to market challenges (Nitithamyong and Skibniewski, 2006). Therefore, an exploration into new ways of managing construction projects to improve the current practice is necessary (Zou and Roslan, 2005). Several studies (Lappe and Spang, 2014; Patanakul *et al.*, 2010; Sanchez *et al.*, 2019) confirmed that project success rate and site management efficiency increases if project management methods are used. A lot of failures in project delivery has been attributed to improper management of the construction process and organisational management, such as inadequate project coordination and uncertainty about available project information (Abdul Rahman and Gamil, 2019; Sweis, 2008). Oliva & Kotabe, (2019) averred that the current web-based solutions which are compatible with emails or other collaborative software like the BIM can enhance efficiency in communication while reducing the occurrence of personnel related matters that can lead to project failures. This would ensure smooth project work flow, providing accurate, timely and real-time information to be used in resolving constructions issues promptly (Charoenngam *et al.*, 2004; Davidson and Moshini, 1990). Similarly in a related development of a Web-based Project Management System, Izang *et al.* (2016) posited that WPMS enhances unity amongst project participants, improves communication and creates collaboration networks between stakeholders and project managers which improves project monitoring.

The willingness to collaborate between professionals is assumed a direct reflection of the inherent benefits and impact it has on project delivery (Faris *et al.*, 2019). Siti *et al.*, (2013) conducted a research on the factors that lead to collaboration in the industry and, the important drivers found include that; collaboration encourages teamwork, develops cooperation, stimulate information sharing, improves work quality, reduces project completion time, enhances service quality, and improves communication among project participants. In a related research, (East *et al.*, 2004) posited that web collaborations have been seen to impact economically on the design review process which is an improvement over traditional manual methods of comment collection and resolution by reducing time required to conduct a design review, number of participants, meeting times and travel cost by up to 73%.

3. Methodology

This study was carried out among construction professionals in the built environment employed by firms registered with the University of Ilorin to offer construction services. The research is designed to obtain secondary information from literature and primary information from a spectrum of practicing built environment professionals through interviews and questionnaires. The mixed method (Interviews and questionnaires) is used because it is a good design approach for solving a recognized research problem by collaborating results and setting up frameworks that provides the researcher with a definite pattern (Creswell and Creswell, 2018).

University of Ilorin was selected as the study area because over the years the university consistently delivered construction projects on annual basis. The population comprises the list of One Hundred and Fifty - Eight (158) registered Firms with the Physical Planning Unit (PPU) of the University of Ilorin.

Literature was reviewed to excise the features of WPMS, the potential benefits and impact of WPMS on project delivery. Fifteen (15) semi-structured interviews were conducted to obtain information from professionals on the level of awareness of WPMS and their perception on the shortcomings, constraints and benefits of using the systems. Convenience sampling was used to select professionals interviewed but ensuring they cut across several work spectrum (Table 1). Creswell and Creswell (2018) defines convenience sampling as a method where the researcher selects participants because they are willing and available to be studied.

Table 1: Schedule of Interviews (Source: Researchers Field Work, 2019)

Work Spectrum	Profession Interviewed	Face-to-Face	Telephone
Architectural firm in practice	Architect	2	2
Quantity Surveying firm in practice	Quantity Surveyor	3	1
Civil engineering firm in practice	Civil & Structural Engineer	1	1
Services engineering firm in practice	Mechanical Engineer	2	
Building Contracting Firm	Structural Engineer	2	1
	TOTAL	10	5

All professionals interviewed are registered professionals with relevant professional institutions and they occupy senior management positions as principal partners or project managers who are policy makers in their respective firms. The face-to-face interview took about twenty-five (25) minutes each, while telephone interviews took an average of fifteen (15) minutes each. All the interviews were recorded and content analysis and discussion carried out on verbatim transcriptions to reveal the significant positions from the professionals interviewed.

A questionnaire survey of built environment professionals was also carried out. Professionals were purposively selected from Ninety-Seven (97) firms, comprising a homogenous sample because of their involvement in construction projects with the University of Ilorin. Creswell and Creswell (2018) explains that in homogeneous sampling the researcher purposefully samples individuals or sites based on membership in a subgroup that has defining characteristics. The questionnaire used was constructed to elicit responses to determine the perception of professionals on the impact of WPMS on project delivery based on Seventeen (17) project activities influencing four (4) project benefit factors. Respondents were requested to measure their perception of the impact WPMS has on the project activities on a five-point Likert scale with respondents who strongly disagree having a point of 1 and 5 points for respondents who strongly agree. Questionnaires were distributed by hand and via email to construction professionals employed by the firms selected. From a total of 97 questionnaires

distributed, 76 was retrieved and used for analysis representing 78% response rate. Data for the study was processed and analysed using average mean on IBM SPSS Statistics 25.

The survey instrument consists of two (2) sections. The first section sought information on the personal and organizational characteristics of respondents while the second section elicited information on the perception of built environment professionals on the impact WPMS has on project activities identified from literature. The test-retest method was adopted as reliability test on the research instrument; this allows the instrument to be administered at two different times.

4. Data Analysis & Research Findings:

4.1 Interviews Results:

The first set of interview questions investigated awareness of WPMS in the industry. Twelve (12) of the respondents (80%) have no knowledge of WPMS and were not aware of any firm or agency that uses WPMS hosted by an ASP. The other three (3) respondents (20%) have limited knowledge. All the respondents however revealed that they are familiar with using multiple web technologies in an attempt to achieve similar objectives as obtainable with WPMS.

The second set of questions investigated the perception of professionals on the shortcomings, constraints and benefits of WPMS. Eleven (73%) of the respondents interviewed agreed that in the face of the benefits, the shortcomings can be seen as challenges to be solved. However, 4 (27%) of the respondents insist that the constraints would be fundamental and strategic to firms and client agencies willing to employ WPMS for construction projects.

The third set of questions examined the perception of the professionals on the impact WPMS will have on project delivery. Ten respondents (67%) agree that WPMS will impact greatly on project delivery, however five respondents (33%) disagree on the perceived impact WPMS can have on project delivery. They averred that the disadvantages far outweighed the suggested impact, attributing much of the reasons to the slow informatisation of the construction industry in Nigeria.

The final set of questions investigated professionals' willingness to adopt WPMS for their projects and the likely future for it in Nigeria. All the respondents (100%) agree that where it is affordable, they are disposed to adopting it. However five (33%) of the respondents believe it is yet a sustainable system in Nigeria. A summary of the interview results is presented in table 2 below

Table 2: Summary of Interview Results. Source: Researchers Field Work, (2019)

Interview Results	Positive Response	Negative Response
	Aware	Not Aware
Respondents awareness of WPMS	20%	80%
	Beneficial	Not Beneficial
Respondents perception on the benefits of WPMS	73%	27%
	High Impact	Low Impact
Respondents perception on the impact of WPMS	67%	33%
	Willing	Not Willing
Respondents willingness to adopt WPMS	100%	0%

4.2 Questionnaire Survey Results

4.2.1 Personal and Organizational Characteristics of Respondents

Experience of professionals for the study was sacrosanct and the respondents show a good percentage of matured professionals with 83% of the respondents above 35 years of age and 77% having more than ten years' experience in the industry. In addition the distribution showed that 55% has additional degrees with 75% being corporate members or fellows of their respective professional

institutes. Hence, this confirms that majority of the respondents have requisite experience in the Nigerian construction industry to provide information for the study.

Quantity surveyors, Civil/structural engineers, and architects rank highest amongst the professionals selected with 26%, 26% and 25% respectively; mechanical services engineers are 10%; and electrical services engineers are 13%. Majority (53%) of the respondents organizations are contracting firms while 47% are consulting firms. All professionals have been in active service in their respective firms for a period above 5 years. Hence they have the basic knowledge of their organisations processes. Equally all the organisations sampled have more than 5 years' experience in the industry.

4.2.2 Perception of Respondents on the Impact of WPMS on Project Delivery:

The activity factors examined are presented under four (4) primary benefits. The activities best describes the benefits of WPMS to construction project management and delivery. The mean scores of the activities indicates the perception of professionals on its impact to project delivery. The benefits presented and the number of activities examined in each are:

- i. Enhancement of communication and collaboration examining four (4) activities;
- ii. Cost reduction and time savings examining five (5) activities;
- iii. Productivity improvement and partnerships examining four (4) activities; and
- iv. Supporting e-commerce and customer relations examining four (4) activities.

The individual mean score of each activity is presented together with the cumulative mean of the benefit they are examined under. The benefits are ranked according to the weight of the cumulative mean score for each benefit. The respondent's perception on each of the activities are presented in table 3 below.

Table 3: Benefits of WPMS (Source: Researchers Field Work, 2020).

Primary Benefits	Project Activities Factors	1	2	3	4	5	N	MEAN
Enhancement of Communication & Collaboration	Improves sharing & exchanging project information	2	5	7	20	42	76	4.25
	Eliminating paper reports and paper trails	2	5	5	25	39	76	4.24
	Improves parties awareness of project Issues	1	4	9	24	38	76	4.24
	Easy access and retrieval of project Information	2	6	10	18	40	76	4.16
	Mean Score of Benefit							4.22
Cost Reduction and Time Saving	Eliminating delays due to updating of drawings	7	6	5	20	38	76	4.00
	Reducing visit to site & traveling time for meetings	9	9	15	29	14	76	3.39
	Reducing time & money spent on disputes	7	2	0	28	39	76	4.18
	Reduction of general project delays	4	3	1	33	35	76	4.21
	Quick solution to managerial challenges	3	1	6	29	37	76	4.26
	Mean Score of Benefit							4.01
Productivity	Reduces and avoids drawing mistakes	9	27	5	22	13	76	3.04

Improvement & Partnership

Automate repetitive routine processes	10	7	4	31	24	76	3.68
Providing timely & concise information to enhance productivity of face - to - face meetings	9	14	0	22	31	76	3.68
Enhancing Knowledge Management (KM) & stimulating Organizational Learning (OL)	1	3	0	21	51	76	4.55

Mean Score of Benefit 3.74

Supporting E-Commerce & Customer Relations

Re-engineers processes in organizations value chain	12	21	27	12	4	76	2.67
Shorten lead-in times for material procurement	17	19	6	21	13	76	2.92
Lower cost and input efficiency and productivity of commercial aspects of projects	5	9	1	23	38	76	4.05
Improves customer service and e-procurement	0	9	9	25	33	76	4.08

Mean Score of Benefit 3.43

5. Discussion of Findings:

Despite the existence of WPMS for over a decade, its awareness in the Nigerian Construction Industry still needs to be intensified as 80% of the respondents' clearly showed no knowledge of WPMS and the other 20% showed limited knowledge but argued that only multinationals employ WPMS on projects. This supports findings from similar research in other countries (Zou and Roslan, 2005, Bhazad and Sanad, 2010). It is encouraging that 100% of the respondents see the benefits of improved collaboration, communication, coordination and construction project management outweighing the shortcomings but 27% of the respondents observed the constraints of low financial capacities, apparent limited turnover of individual firms, inadequate IT skills and the erratic power supply in Nigeria as fundamental. Thirty-three percent (33%) of the respondents believe the adoption of WPMS on projects may not improve aspects of delivery except communication, they argue that project delivery is largely dependent on the expertise of the managers and not the tools employed. They posited that despite the use of WPMS, project delivery may be hindered when the managers are not competent. However 67% of the respondents agree that WPMS impact would be felt on project delivery by reducing time and cost. This is consistent with the main survey that revealed the perception of professionals on the impact WPMS has on project delivery. Professionals perceived that highest impact will be on enhancement of communication and Collaboration; closely followed by cost reduction and time saving activities with mean scores of 4.22 and 4.01 respectively. This result supports the observation that sophistication in ICT use such as WPMS will impact on communication and collaboration through enhanced capture of information from all meridians for project delivery by project managers (Izang *et al.*, 2016; Obradovic *et al.*, 2014; Poriya *et al.*, 2020). Other benefits examined are productivity improvement and partnerships and; supporting e-commerce and customer relations with mean scores of 3.74 and 3.43 respectively.

All respondents agree that it will improve collaboration and exchange of information between organizations. This is predicated on the document management; collaborative; and data export features of WPMS and also consistent and true with other findings in previous research (Izang *et al.*, 2016; Nitithamyong and Skibniewski, 2004; Orzohon *et al.*, 2014). The professionals also showed

reasonable disposition to adopting WPMS where it is affordable. They however laid emphasis on the fact that ASPs' are yet domiciled in Nigeria, hence foreign exchange may make it impractical to host. Professionals also expressed optimism that where funding and client agencies adopt WPMS, beneficiaries and other project participants will have to adopt too because the cost transfer to individual firms will be minimal.

6. Conclusions and Recommendations:

The potential benefits outweighing the shortcomings and the professionals' disposition to adopting WPMS despite the constraints supports the conclusion that WPMS provides benefits to construction, hence embracing new project management methods through the use of WPMS in Nigeria will enhance project delivery and improve collaborations. In addition, this research revealed that it is generally agreed among professionals who have participated in the University of Ilorin projects, that WPMS could improve construction project delivery and, in time, could become a primary Project Management system.

It is recommended that improving awareness of WPMS will expose its potential benefits. Furthermore, encouraging funding agencies like the Tertiary Education Trust Fund (TETFund), and Client organizations like Universities to adopt WPMS will enhance its prominence amongst professionals. Despite that it is generally postulated that WPMS systems will be the main platform for project management and the facilitation of communication and collaboration in the future, more research is required to investigate limiting factors responsible for its slow adoption in Nigeria. Similarly the emergence of new technologies like the Building Information Modeling (BIM) is currently revolutionizing the construction industries all over the world. Studies on the expectancies of WPMS in the face of this new emerging technologies should be investigated. Finally, it is necessary to encourage all firms to mount necessary ICT equipment required for easy transition to the adoption of these technologies. In addition, improving IT skills required for its adoption through skills education and training should be encouraged.

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