

CLOUD BASED STORAGE APPLICATION AS A PROJECT INFORMATION MANAGEMENT TOOL FOR GRADE G5 CONTRACTORS IN SELANGOR

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ABSTRACT

Information management is a vital component of any construction project. Poor communication and collaborations due to poor information management can have a negative effect on project. Small and medium sized organizations face many challenges to adopt high-end project information management software. In such cases, cloud based storage application can offer a feasible solution. This research will focus on the adoption of cloud-based storage application for the G5 contractor in Selangor. Literature review and questionnaire survey were used in the data collection exercise. The study revealed the top three of cloud-based storage application in the industry and there are four (4) critical success factors for adopting cloud based storage application. The aim of this research is to look into the adoption of cloud-based storage applications for small and medium sized contractors. This research is focusing on G5 contractors in Selangor. The output of this research can give a good insight into the industry and help to G5 contractors to adopt cloud-based storage application to improve their information management.

Keywords:

Cloud base storage application, G5 contractor, project information management, Selangor, Malaysia

INTRODUCTION

Information management is a vital component of any construction project. Poor communication and collaborations due to poor information management can have a negative effect on the project. The main reasons for bad information management in the construction industry are the use of traditional means of communications, use of conventional hardcopy storage and fragmented nature of the industry itself. These reasons can be usually overcome by application of new technologies such as project information management software to improve information management of a project.

The small and medium sized contractors are the backbone of the construction industry. They are important not only in small scaled projects, even in large construction projects managed by large contractors, the majority of actual construction works are sub-contracted to small and medium sized organization. Contractors in Malaysia are graded by Construction Industry Development Board (CIDB) according to their net worth and tendering capacity. In this research CIDB grade G5 contractors are categorized as medium sized contractors.

Small and medium sized organizations face many challenges to adopt the high-end project information management software such as the high initial cost and lack of dedicated technical personal to operate it as reported by (Hooks, 2013). Therefore it is not a feasible solution for small and medium-sized organizations. By using the cloud-based storage applications, this will help small and medium-sized organizations to tackle the poor information problems (Michael & Jill, 2013). The features of the cloud-based storage applications make them a suitable option for this purpose such as storing the documents in the cloud and file sharing. By doing so the files can be shared amongst the project team and it can be accessed at anytime and anywhere.

Nourbakhsh et al., (2012) reported that many significant types of research have been done on the development and application of the cloud-based storage application, but there is a lack of research on small and medium organizations usage. This research will focus on the adoption of cloud-based storage application for the G5 contractors group in Selangor. In order to achieve it, the research objectives are (1) to evaluate and compare top three (3) cloud-based applications in the construction industry, (2) to investigate the current usage of cloud-based application among G5 contractors in Selangor and (3) to predict the critical success factors for adoption of cloud-based application G5 contractors in Selangor.

According to CIDB, (2015) G5 contractors are classified as construction organizations that have a net worth of RM 250,000 and tendering capacities of not more than RM 5 million. The justification for choosing G5 contractors, because they make up the majority of the construction industry as reported by the CIDB, (2015). There are currently 1253 registered G5 contractors in Selangor as reported by CIDB, (2015).

CLOUD BASED TECHNOLOGY

The construction industry has been a real catalyst for the economic development enjoyed in recent years, as infrastructure development has been at the core of both the Economic Transformation Program (ETP) and the Tenth Malaysia Plan as reported by (Mohd Fateh et al., 2016). The majority construction industry has shown a comparatively low usage of cloud-based technologies to improve its operation as stated by (Alshawi & Ingirige, 2003). (Pena-Mora & Tanaka, 2002) also highlighted that the construction industry is still primarily exchanged by conventional human communication and printed drawings or documents. (Kumar, Cheng, & McGibbney, 2009) suggested that cloud-based storage application could hold potentials for resolving some of the most demanding needs of the construction industry. It is believed specifically cloud-based storage could increase significantly the usage of information management technology among the small and medium-sized construction organizations mainly due to the prices and costs involved with cloud computing is considerably less than conventional technology.

Cloud-based storage application offered to the general public. The basic services which are free namely cloud storage space and file sharing. For the premium and advanced features such as larger storage space, support for different file type and unlimited file sharing. According to (Scott, Cheong, & Li, 2003) cloud-based storage application can utilize the browsers, data handling devices and other Internet technology to create a network for sharing and manipulating corporate information in a way that will assist construction project managers to complete work

on time and within budget. This research will focus on the top three (3) cloud-based storage applications according to market share. Based on the report by (Griffith, 2015) the top 3 three (3) cloud-based storage applications are Dropbox, Google's Drive and Microsoft's OneDrive. Table 1 summarizes the features of the three (3) applications.

Dropbox

Dropbox is most commonly used cloud-based storage application. Dropbox is estimated to have over 300 million users according to (Griffith, 2015). Dropbox has many features such as allowing file sharing to users who don't have a dropbox account. The most basic plan of Dropbox is for individuals and is free, it offers 2GB of storage and integration with Microsoft 365. This allows editing of documents directly within the Dropbox platform. The basic plan can be upgraded to 1TB of storage. The business plan offers unlimited storage and numbers of users can add according to the organization's needs. Dropbox also has mobile application integrations, which means the users can use mobile devices such as tablets and phones to view and edit documents.

Google Drive

The main benefit of Google Drive is team collaborations. Google Drive also offers storage and file sharing, but it is in terms of team collaboration that it really shines. The documents can be edited simultaneously by different team members in real time. It also offers built-in chat tool to talk to other team members. Google drive also has integration with 3rd party software such as project management software. The price of Google Drive is very competitive with that of Dropbox and like Dropbox Google Drive also has mobile integration in the form of mobile application.

Microsoft Onedrive

Microsoft OneDrive has about 250 million users as reported by (Griffith, 2015). OneDrive offers limited free storage and excellent integration with Windows operating systems. Like Dropbox and Google Drive it also has mobile integration and can be used on mobile devices.

Table 1: Summaries of top three (3) cloud-based applications.

	Dropbox	Google Drive	Microsoft OneDrive
Free Storage	2GB	15GB	5GB
Price per GB (Paid Plans)	USD 0.008	USD 0.01	USD 0.007
Supported Operating Systems	Windows, Mac	Windows, Mac	Windows, Mac
Supported Mobile Platforms	Android, iOS, Windows Phone, BlackBerry, Kindle Fire	Android, iOS	Android, iOS, Windows Phone
File size Limit	Website: 10GB. Application and Mobile Application: Unlimited	Documents: 50MB for Google Docs, Other documents: Up to 1,024,000 characters. Spreadsheets: 2 Million cells. Presentations: 100MB. Drawings: Unlimited. Other Files: 5TB	10GB
Private File sharing	Yes	Yes	Yes
Public File sharing	Yes	Yes	Yes
Synchronization amongst all platforms	Yes	Yes	Yes
Collaborative Editing	Yes	Yes Including real time editing.	Yes

From table 1, the comparison shows that broadly all three applications offer similar functions such as public and private file sharing, synchronization amongst all platform and collaborative editing. The significant differences will on the price per GB for the storage and sizes that are allowed to be uploaded. The features and cost of cloud storage application are suitable for project information management in a medium size contractor. The findings will contribute the contractor in making decision when choosing the cloud storage application that meets their budget and requirements.

METHODOLOGY

The amount of data required to achieve the objectives of this research is the significant number of respondents. Quantitative method is used for this research. The questionnaire survey was conducted with the key construction professionals of the G5 contractors such as project managers, engineers, quantity surveyors and others. The ideal target respondents for questionnaire were the personal who is in charge of the information management during the projects. The questionnaire is designed into three (3) sections. Section A is focusing on the general information of the respondents and the organizations. While section B and C focus on the second and third objectives of the research respectively. The data collected from the questionnaire survey will be analyzed using the Google Forms application and Microsoft Excel software. For section A and B, frequency analysis is used while for section C the relative importance of was quantified by the relative importance index (RII) method prior to ranking. The target population for questionnaire survey is 1253 registered G5 contractors in Selangor based on the report by (CIDB, 2015) therefore, simple random sampling was used. In order to determine the sample size, the confidence level was set to 95% while the margin of error is 10%, the sample size is 90. Therefore, 200 questionnaire sets were distributed but only 120 questionnaires were sent back.

RESULTS AND DISCUSSION

Top three respondent's designations were project managers (25%), followed by engineers (22%) and administrators (19%). Figure 1 summarizes on the respondent's designations. Most of the respondents that participated in the survey have vast experience in the construction industry. According to figure 2, 42% of the respondents have more than 10 years of experiences followed by 33% have 1 to 5 years experiences and 25% have 5 to 10 years experiences in the construction industry. Figure 3 illustrated the respondent's usage on cloud-based storage applications. 55% of the respondents are using cloud-based storage application as a tool to facilitate their task. Figure 4 summarizes the years of respondents experienced in using cloud-based storage application. The majority of the respondents (57%) have been using cloud-based storage application for 1 year to 3 years. From the data collected, it represents that respondents are experienced both in the construction industry and cloud-based storage applications. Therefore, the data collected is considered to be reliable and good for the survey.

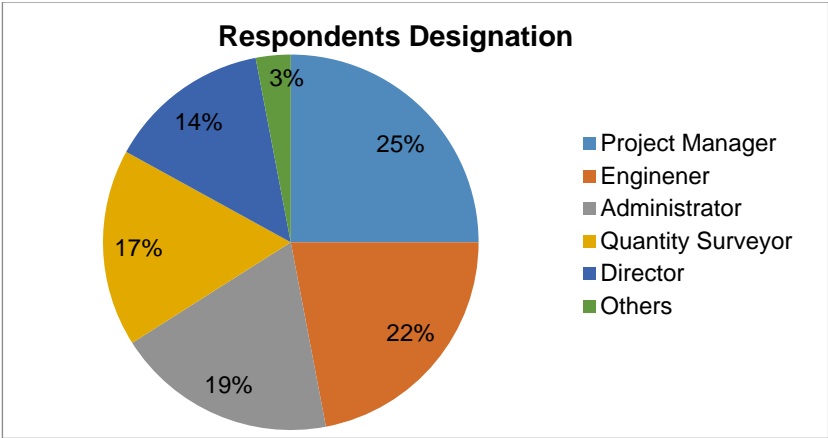


Figure 1: Respondent’s designations

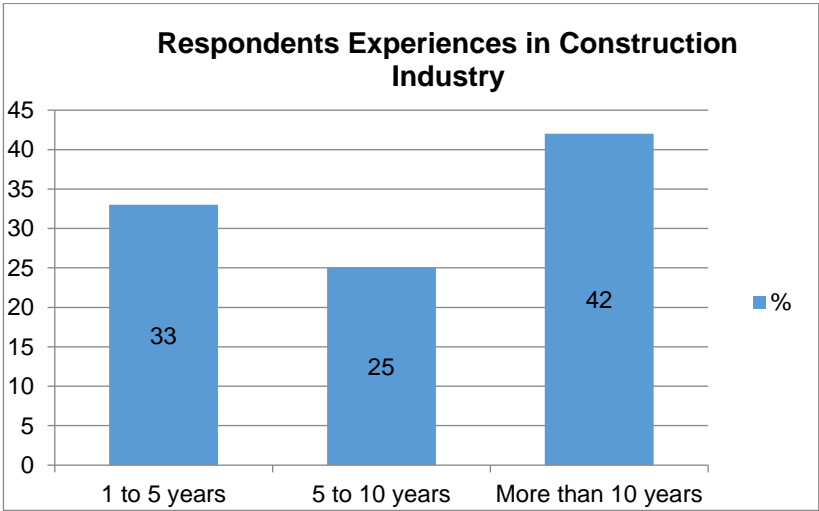


Figure 2: Respondent’s Experiences in Construction industry

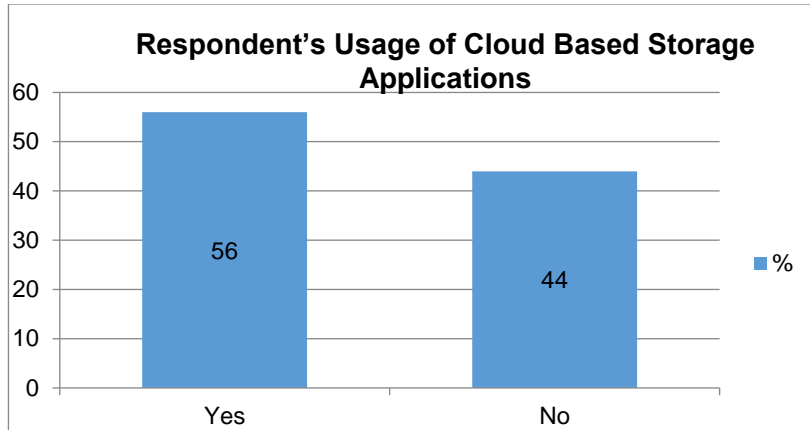


Figure 3: Respondent's Usage of Cloud Based Storage Applications

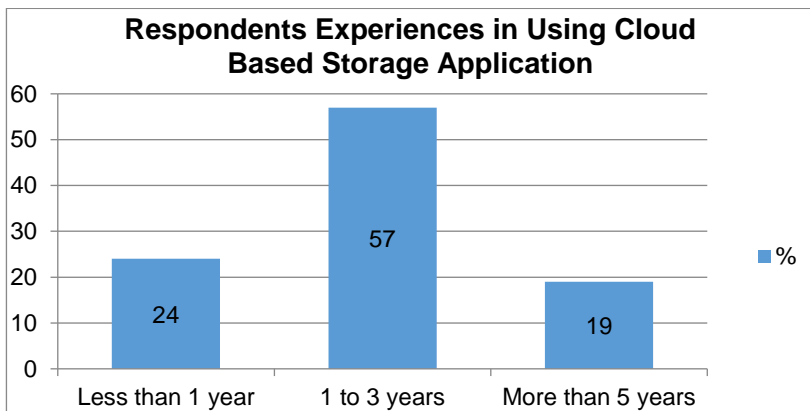


Figure 4: Respondent's Experiences in Using Cloud Based Storage Application

Based on findings from the literature review, respondents were asked the preferred cloud-based storage application. Figure 5 show that majority preferred Dropbox as their cloud-based storage application. Table 2 ranked the selection criteria for the cloud-based storage application. The most important selection criteria for the respondents are the cost, the initial and operating cost respectively. After the cost wise is it followed by the ability of the software to share files with multiple users. The criteria are as expected since the most pressing concern of small organizations like G5 contractors is the cost. The ability to share files with multiple users is mandatory functions for any software that can be used to manage the information of a project, as the files have to be shared with the many stakeholders and the many employees of the contractor. Based on table 3, the respondents admit that use of cloud-based storage application has made sharing of project information easier and has made communication amongst stakeholders easier. They also agreed that use of cloud-based storage application allowed the project team to focus more on the actual construction. These results show that the use of cloud-based storage application can have a noticeable positive impact on a project and construction industry as a whole. Table 4 illustrated the critical success factor for adopting cloud based storage application. The respondents agreed

that intensive training for staffs of the organization is vital for successful adopting of Cloud-based storage application. It needs to cover that on the step by step usage and features of the application. The respondents also agreed that awareness amongst the stakeholder is vital. When the awareness among stakeholders is high, it able to translate into using all features that the application offers.

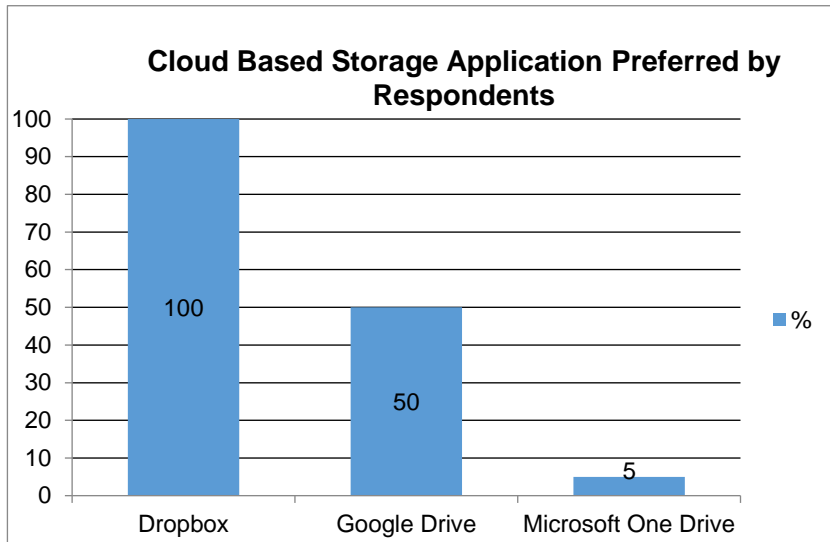


Figure 5: Cloud Based Storage Application Preferred by Respondents

Table 2: Selection Criteria for Choosing the Cloud Based Storage Application

Selection criteria	RII	Ranking
The initial cost of the software.	0.90	1
The operating cost of the software	0.88	2
Able to share the files with multiple users.	0.84	3
The size of free storage provided.	0.80	4
User friendliness / Ease of use.	0.79	5
The security features.	0.78	6
Able to use on mobile devices.	0.72	7
Able to simultaneously do editing.	0.71	8

Table 3: Impact of Using the Cloud Based Storage Application

Impact of Using Cloud Based Storage Application	RII	Ranking
Sharing of project information easier.	0.86	1
Communication amongst stakeholders easier.	0.84	2
Allowed the project team to focus more on the actual construction.	0.81	3
Reduced the cost of projects.	0.71	4
Improved the quality of projects.	0.67	5
Reduced the completion period of projects.	0.62	6

Table 4: Critical Success Factors for Adopting Cloud Based Storage Application

Critical Success Factors for Adopting Cloud Based Storage Application	RII	Ranking
Intensive training for staffs of the organization	0.94	1
Awareness about cloud-based storage application	0.82	2
Make it compulsory or policy in the organization on the usage	0.81	3
Able to use on mobile devices	0.78	4

CONCLUSION

The conclusions are based on the three (3) objectives of this study. Objective 1, to evaluate and compare top three (3) cloud-based application in the industry. Based on the findings from the literature review, the top three used software available were identified as Dropbox, Google Drive and Microsoft OneDrive. Table 1 summarizes the comparison shows that there is little actual difference between the three application and all three are suitable for use by G5 contractors. For objective 2, to investigate the current usage of cloud-based application among G5 contractors in Selangor. Based on the analysis from the questionnaire survey, 56% of G5 contractors use cloud-based storage applications as illustrated in figure 3. 57% of them have been using the application for 1 to 3 years as stated in figure 4 and 100% of them preferred using Dropbox as summarized in figure 5. Lastly for objective 3, as stated in table 4 intensive training for staffs of the organization is the critical success factor for adoption of the cloud-based application. Apart from that, respondents agreed that the important selection criteria for the cloud-based storage application will be the initial cost of the software. As G5 contractors are small and medium organizations, the initial investment will always play a big role in adopting new technologies and methods.

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REFERENCES

- Alshawi, M., & Ingirige, B. (2003). Web-enabled Project Management: An Emerging Paradigm in Construction. *Automation in Construction*, 12(4), 349–364.
[http://doi.org/10.1016/S0926-5805\(03\)00003-7](http://doi.org/10.1016/S0926-5805(03)00003-7)
- CIDB. (2015). Contractors Directories. Retrieved November 30, 2015, from <http://smb.cidb.gov.my/directory/contractors>
- Griffith, E. (2015). Who's winning the consumer cloud storage wars? Retrieved December 25, 2015, from <http://fortune.com/2014/11/06/dropbox-google-drive-microsoft-onedrive/>
- Hooks, J. (2013). Project Management Software Advantages and Disadvantages. Retrieved November 30, 2015, from <http://www.business2community.com/strategy/project-management-software-advantages-and-disadvantages-0412921#VRggQ5EV4xeojgdw.97>
- Kumar, B., Cheng, J. C. P., & McGibney, L. (2009). Cloud Computing and its Implications for Construction IT. *Proceedings of the International Conference on Computing in Civil and Building Engineering (Iccbe 2010)*, 1–6.
- Michael, M., & Jill, D. (2013). The Best Cloud Storage File-Sharing Services. Retrieved November 30, 2016, from <http://www.pcmag.com/article2/0,2817,2413556,00.asp>
- Mohd Fateh, M. A., Mohammad, F. M., & Abd Shukor, A. S. (2016). Review in formulating the standard form of contract for Industrialized Building System (IBS) construction approach in Malaysia. *The 9th International Unimas Stem Engineering Conference (ENCON 2016) "Innovative Solutions for Engineering and Technology Challenges,"* 87(MATEC Web Conf.), 7.
<http://doi.org/https://doi.org/10.1051/matecconf/20178701001>
- Nourbakhsh, M., Zolfagharian, S., Mohamad Zin, R., & Irizarry, J. (2012). Affordable Software for Collaboration, Document Management, and on-site Information Management in Small- and Medium-sized Construction Companies. *International Journal of Engineering and Technology*, 4(4), 460–463. <http://doi.org/10.7763/IJET.2012.V4.410>
- Pena-Mora, F., & Tanaka, S. (2002). Information Technology Planning Framework for Japanese General Contractors. *Management in Engineering*, 18, 138–149.
- Scott, D., Cheong, M., & Li, H. (2003). Web-based construction information management systems. *The Australian Journal of Construction Economics and Building*, 3(1), 43–51.