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Summary

It can be difficult for SME's to compete against larger firms in the construction industry. In the modern industry it is essential for any company, regardless of size to have a virtual presence to collaborate on projects on a global scale. However the big problem for SME's is that they are unable to set their own ICT platform due to a number of constraints. They don't have the staff with the necessary skills to create one, the time train their staff on how to create one or the resources to hire another company to create an ICT platform for them.

The solution to this problem is using a virtual organisation. However as there is many different virtual organisations it is essential that the SME chooses a virtual organisation that meets all of their requirements. The virtual organisation should provide communication methods such as live messenger, voice and video calling to ensure a rapid communication between all parties. It should provide a document sharing and document storage options to reduce the amount of unnecessary emails sent between both parties. This should also ensure that the most updated versions of documents should be available to everybody involved in a project without having to request the information. It should also provide a form of security to ensure that all the project data is safe from being shared with people not involved in the project.

A number of virtual organisation were researched and compared based on the requirements mentioned above. For a virtual organisation to provide a suitable option for the construction SME, it needs to fulfil all of the requirements. The virtual organisations that were analysed and compared were Slack, Asana, Workplace by Facebook, Samepage and Trello. After the analysis was performed it was determined that Asana and Trello did not meet the communication requirements of the SME so they were ruled out as a suitable option. In terms of document sharing and storage, Workplace provided less options than Slack and Samepage meaning that Slack and Samepage were the two best options for a virtual organisation for the construction SME.

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Declaration

I hereby declare that this report is my own work and effort and that it has not been submitted anywhere for any award. Where other sources of information have been used, they have been acknowledged

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1. Introduction

In a construction project there will always be a number of contractors, sub-contractors, designers and clients involved in a project. With all of these different entities involved in a project, it can be time consuming to share all the required information with all of the different entities. The use of email has become outdated as files can easily become buried leading to an overall poor knowledge management system. The solution to this knowledge management problem is the use of a virtual organisation. [1]

A virtual organisation is an ICT platform that allows teams and groups to collaborate together on projects. As it is a cloud based service it enables collaboration from everybody involved in a project regardless of their location as long as they have an internet connection. It provides communication services such as real time chat in the form of live messenger, voice and video calling. It provides services such as document sharing and document storage that can greatly reduce the number of mistakes in a project by improving the communication process. The virtual organisation has developed rapidly in recent years, this will be illustrated in the report as most of the virtual organisations analysed have been created within the past 10 years.

By adopting a virtual presence in the construction sector, an SME can add value to its own business in terms of how beneficial it is for other companies in the construction industry to work with them. Without a virtual presence, an SME is limited to local project and not making itself available globally. The value added by a virtual presence is crucial for an SME to compete and survive in the current construction industry. [2]

There are a number of different virtual organisations that could potentially solve the problems of the construction SME. In this report a number of different virtual organisations will be analysed to determine how they can benefit the Small Medium Enterprise (SME). For a virtual organisation to be considered it must meet all the construction SME requirements in terms of communication, document sharing, document storage and security. If a virtual organisation cannot meet all of these requirement then it will be considered unsuitable for the construction SME. All of the virtual organisation analysed will be assessed on the functions that they provide to determine which virtual organisation provides the best solution to the construction SME.

2. Problem

When part of a larger project, construction SME's encounter many communication and file sharing problems that hinder them from providing the best possible service. It is impossible for them to set up an ICT infrastructure as they do not have the staff with the required skill set to set up the platform, the time to train current staff on how to create and set up an ICT infrastructure or the resources to employ skilled staff to set up the ICT platform. This lack of skills, time and resources makes it very difficult for the SME to be competitive in the construction industry and forces them to look for other solutions such as virtual organisations. The biggest problems that the virtual organisation have to solve for the SME are listed below.

2.1 File Sharing

File sharing is probably the biggest problem that the construction SME encounters. While emailing project files may have been effective in the past, it is not a sustainable method of communicating project proposals or building models in the modern era with long email chains making it difficult to find information. There are a number of problems that can be encountered when emailing project files that will be discussed below.

2.2.1 Buried Files

When a file is emailed it can become buried within in inbox or put at the end of a long chain of emails which can make it very difficult to find, this may require the recipient to request the document again which in turn adds unnecessary communication between the two parties whilst also wasting time by repeating a task. Files may also become buried in an email archive making it impossible for a party to access the file and thus making email unsustainable as a form of document sharing.

2.2.2 Updated Documents

Another big problem is that documents are constantly being updated to remove any mistakes or inputting any requested changes. In terms of communicating these changes, constantly emailing updated versions of a file is not sustainable, as it is likely that this will lead to an excessive number of emails which increases the chances of confusion and that an out of date version of a file being used which could lead to mistakes and possibly larger problems in the future of a project.

2.2.3 Loss of Personal

If a person leaves a company, they take their knowledge with them, however the problem is that they can take their knowledge without having communicated it with the rest of their team or other SME's involved in the project. This can lead to communication errors with both parties unsure of something on a project which can lead to time wasted in figuring out how a part of a project was completed. There is also the possibility that work completed on their computer remains on their computer leading to time wasted in getting a member of IT to extract the required documents.

As a construction SME does not have the time, knowledge or resources to implement an ICT infrastructure to solve all of the problems that have been mentioned above, a virtual organisation is crucial so that they can survive and compete in the construction industry.

3. Proposed Solution

The best solution for all of the problems mentioned in section 2 could be potentially solved with the use of a virtual organisation. However for a virtual organisation to be beneficial it would have to meet all needs of the construction SME. If a virtual organisation cannot meet all of the requirements set out by an SME, then it is not a sustainable solution. A number of virtual organisations will be analysed and compared to determine which ones meet of the requirements stated above and which virtual organisation provides the best overall service to the construction SME. All of the requirement are specified and discussed in section 4 of this report.

4. Virtual Organisation Requirements

The main requirements of a virtual organisation for the construction SME is that it provides a document sharing platform, a communication platform, a file storage system and cloud storage capacity, and security. All of these requirements will be explained in the next section of the report.

4.1 Document Sharing

As many different types of files are used in the construction industry, the virtual organisation used should be compatible with all relevant software. This can range from Microsoft package which includes word, excel and project, to more complex software's such as IES Revit and AutoCAD. Whilst being compatible with these software is the requirement, a document viewing option may at times can speed up the process when a document only needs to be viewed and not downloaded. If the virtual organisation is not compatible with these software then it does not provide a suitable solution to the problems encountered by the construction SME's. However the main aspect of document is that it provides the option for a document to be uploaded so that everybody else involved in the project can access the document without having to request anything. This should also reduce the quantity of unnecessary emails sent by both parties.

4.2 Communication

A communication platform is essential for a virtual organisation as allows for a discussion on a project to ensure that there is no ambiguity about how a task should or needs to be completed. This is turn should reduce the quantity of errors in a project and remove any time delays. It is important that there is a number of different communication methods to make the virtual organisation effective. This is important so that that small questions may be dealt with quickly through live messenger, whereas larger problems can be discussed at length through voice or video chat. The communication method that are required are:

- Real time video and voice chat
- Live messenger
- Live forums

Real time video chat is required to ensure that a project can be discussed in detail by people in remote locations without the ability to meet in person. Live messenger is required so that quick questions may be asked without the requirement for a detailed discussion. Live forums or

discussion boards are required to allow a group of people discuss a project or an aspect of a project while sharing their knowledge with multiple other people involved in the same project.

4.3 Database

While it is essential that multiple forms of documents needs to be shared on the virtual organisation, it also needs to provide a cloud server to store project files. This ensures that anybody involved in the project can access any of the project files at any time regardless of their location. This function enables the users of the virtual organisation to save time as they can go straight to the virtual organisation and work on the required file. This in turn implements a knowledge management system into the virtual organisation which is essential for any size company in the construction industry to make a project run as efficiently as possible. [3]

4.4 Security

Security is a crucial aspect of the virtual organisation. All parties using the virtual organisation need to ensure that the only people who can access and change the files stored in the virtual organisation are the people involved in the project. To ensure that this does not happen, each person that requires access to the virtual organisation will be provided with a username and password. By using a username to log in, other people may also be able see who uploaded a document. This may save time in the future as other people involved in the project will know exactly where to direct their question when using a document on the virtual organisation.

5. Possible Virtual Organisations

5.1 Slack

Slack was released in 2013 as a collaboration software. It provides all of the necessary communication by allowing group and private messaging. It also provides the option to create small groups which is useful when dividing a project in teams. It also integrates third party software's such Google Drive and Dropbox which gives project members to upload and share their documents with the rest of the project team. Box has also been incorporated into slack which allows users to share files through the virtual organisation. Slack has now incorporated a two factor authorization process which ensures a high level of security and that. Slack provides android and IOS applications which ensure that it can be accessed remotely from phone or laptop in terms of communication or document sharing making it versatile and suitable to all users. Here it is illustrated that slack meets all of the requirements of the construction SME stated above in the report in terms of communication, document sharing, document storage and security. [4]

5.2 Trello

Trello was created in 2010 as a project management application. As it was intended as a collaboration software it meets the needs of the SME in terms of document sharing and storage as it provides integrations such as Google Drive. In terms of communication it allows comments to be made in regards to uploaded documents where people can discuss the key aspects of a document. However the problem is that this is the only form of communication provided through Trello. It provides an integration with Slack where further communication

can be performed however this is not productive as Slack provides the all of the file sharing, storage and communication solution by itself. [5]

5.3 Asana

Asana was founded in 2008 as a project management and team collaboration software. The software has been developed for a website and mobile phone app so that it can be accessed remotely from electronic devices. This app includes security controls via username and password to ensure that all the data contained is secure. This is done through integrating the Okta and Onelogin software which uses a single sign on process and ensure no security breaches through other app integrations. The app now includes a csv importer so that raw data can now be uploaded. It has integrated communication methods such Gmail and Microsoft Outlook to ensure that a communication method has been established through the software. However it has also integrated software such as Dropbox, Box and Google Drive to ensure that varies file types can be uploaded and shared through the software. As well as the mentioned above Asana integrates with intagantt to provide a time management project workflow schedule to save time for the SME. [6]

5.4 Samepage

Samepage is collaboration software that was created in 2013. It meets all the requirements of the construction SME in terms of communication as it provides live messaging, group messaging, phone and video calling which removes the need for long message chains where files and documents can become buried. It also gives the option to add comments to files which may provide other document users and remove the need for questions to be asked above certain aspects of a document. This in turn could reduce the quantity of unnecessary email sent about the document. It allows documents to be shared through the website or through an integrated cloud server such as Dropbox whilst also allowing documents stored, viewed and download. An extra function that this software provides is a file version history to ensure that everybody involved is aware of any changes made to a project and that an out of date file is not being used. In terms of security, users have the option to share a document with a whole group or just the required people. This ensures that only the necessary people see a project file. [7]

5.5 Ryver

Ryver is project collaboration software that aims to meet all the needs of a project. In terms of communication it meets all the needs of the construction SME by providing group messaging with the option to search all previous messages to ensure that there is no loss of knowledge through the project lifecycle. It also provides video and voice calling services which ensure that remote work on a project is not a problem. However it also provides a screen sharing function to help project members communicate their idea and work in a clearer manner ensuring the best possible communication methods. It integrates with various other application such as Dropbox and Box allowing files to shared and stored removing the need to send a long string of email requesting various different documents. In terms of security, Ryver uses a single sign on process to ensure that only project members can gain access to uploaded documents. This illustrates how Ryver meets all of the requirements of the construction SME. [8]

5.6 Workplace by Facebook

Workplace by Facebook was developed by Facebook as cheaper alternative to the standard virtual organisation. In terms of communication it meets all the construction SME as live messenger, video calling, voice calling and group conversations are all provided through Workplace by Facebook. However an auto translate service is also provided which enable collaboration from people who may speak a different language. Workplace by Facebook has many file sharing and file storage integrations to meet the needs of the SME such as Dropbox, google drive and Box. It meet the security needs of the SME with integrations such as Smarsh, Netskope and Aware. These integrations ensure that files are not accidentally deleted while also ensuring that all project sensitive data is protected so that only project members can see the project documents. [9]

6. Virtual Organisation Comparison

The tables below shows comparisons of the virtual organisations discussed in section 5. It shows which features each platform provides in terms of communication and file management to determine which virtual organisation is best suited to construction SME.

6.1 Communication

The table below illustrates which communication feature are provided by each of the virtual organisations discussed in section 5. On the table below, if a box is black then that service is provided by the virtual organisation whereas if the box is white then the service is not provided by the virtual organisation.

Table 1: Virtual Organisations Communication Comparison

	Slack	Workplace by Facebook	Asana	Samepage	Trello
Live messaging	Black	Black	White	Black	White
Group messaging	Black	Black	Black	Black	White
Phone calling	Black	Black	White	Black	White
Video calling	Black	Black	White	Black	White
Group video calling	Black	White	White	Black	White

It is clear from the table above that Slack and Samepage provides the best overall communication service as it includes every type of messaging platform required from live one to one and group messaging to voice and video calling. Workplace by Facebook slightly lags behind here as it does not allow group video calling which could be required for a top management meeting. It is clear from the table that Asana is not suitable to the construction SME as it does not provide a live messaging option of any form of voice or video calling. The lack of communication methods provided by Asana hinders them from providing a sustainable solution to the construction SME. This table also make it clear that while Trello may be suited to SME's in other industries, it is not suited to SME's in the construction industry. As it only allows treads of comments to made on files, further communication through phone calls or emails outside of the virtual organisation would be required making it an unsustainable solution the problems of the construction SME's.

6.2 Document sharing and Storage

The table below illustrates the document sharing and storage methods provided by each of the virtual organisations discussed in section 5 of this report. Similar to the table above if a box is black then that service is provided by the virtual organisation whereas if the box is white then the service is not provided by the virtual organisation.

Table 2: Virtual Organisation Document management comparison

	Slack	Workplace by Facebook	Asana	Samepage	Trello
File sharing					
File storage					
File editing					
Cloud file integrations					
File Version History					

The table above clearly shows that each of the virtual organisations provides a form of document sharing and document storage which were two of the main requirements of the virtual organisation. However one thing that is lacking by Slack, Workplace by Facebook, Asana and Trello is a file version history. This is an important aspect as it ensures that the most up to date version of a file is always in use. It lets people know what changes were made to a document so they can take into account any changes that this may cause in their work. Omitting this function could potentially lead to project errors and is something that should be addressed by these virtual organisations. This file version history is available on Samepage which gives it a slight edge over the other virtual organisations.

This comparison shows that while Workplace by Facebook, Asana and Trello are all lacking behind in terms of service provided. Asana and Trello provide satisfactory document storage and sharing services, however the communication platform provided these two virtual organisations does not meet the needs of the construction SME. This would make it difficult for an SME to mark its brand globally. This is where Slack and Samepage stood out as virtual organisations that are best suited to the construction SME as they meet all of the requirement in terms of communication and document management. As their communication methods allow for instant messaging and video calling regardless of location, they have a big advantage over the other virtual organisations. [10]

7. Case Studies

A number of case studies were found where a company implemented an ICT platform to improve their work process. The example below shows how a virtual organisation is effective in practice.

A case study was performed on Pochins PLC, an English construction company. The study outlines how they suffered from communication and document sharing problems before they implemented an ICT platform. This platform included an instant messaging system to ensure that employees could communicate with each other regardless of location. It included an information portal so that people could post project documents. However it also incorporated a forum page where people could post problems and receive help from other people who otherwise would have been restricted due to location.

After it was implemented it was recorded that the ICT platform was being used by 90% of the staff. The form boards were being actively used to solve any project problems while the knowledge being shared across the platform was clearly present in their project.

This case study performed shows how a virtual organisation can be beneficial to a company in terms of communication, knowledge and document management. [3]

8. Conclusion

For an SME to survive and compete in the construction industry is essential that they set up a form of ICT platform so that communicate globally and have the ability to share files at a moment's notice. Although a virtual organisation provides the solution to this problem, not all virtual organisations meet the needs of the construction SME in terms of communication. The lack of communication methods provided by Asana, Trello and Workplace by Facebook make them unsuitable for the construction SME as this is an industry where they may be required to work with other SME from around the world. In conclusion, due to the better communication methods provided, Slack and Samepage appear to provide the best solution to the construction SME needs of all the virtual organisations that were analysed.

While the obvious benefits of the virtual organisation are mentioned above, there is knock-on effect that could potentially make the running of a building easier once construction is finished. When the facilities of a building are being operated and maintained there is often a lack of information on how the building was built and the physical components. By allowing the facility management team access to virtual organisation after the project is completed. They can see all the discussion about how the building was designed and created plus all of the building documentation. All of this information should lead to the building being run in an efficient manner. [11]

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