CE6014 – Computer Mediated Communication

Investigating the Implementation of Enterprise 2.0 into AEC Companies

19 November 2017

MEngSc

Information Technology in Architecture, Engineering & Construction

Samuel Moriarty

114116421

Supervisor: Matevž Dolenc

School of Engineering
Chair of IT in Architecture, Engineering & Construction

UCC
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

ITC Euromaster
European Master Programme in Information
Technology in Construction

Contents

Table of Figures

1. Introduction

The world is fast becoming digitised. It is entering the fourth revolution, which is about the digital transformation of industrial companies. With the world becoming more digitised certain aspects of AEC companies no longer need to be face to face, for example meetings. These can now be held across the world with the use of video conferencing. This is where enterprise 2.0 comes in. Enterprise 2.0 is a term coined by Andrew McAfee, where he stated that "*Enterprise 2.0 is the emergent social software platforms within companies or between companies and their partners or customers".* It is through these software platforms that we will see the fastest evolution of digitisation.

Digitisation is the process of converting information into a digital format. Digitising information makes it easier to preserve, access, and share. There is a growing trend towards digitisation of historically and culturally significant data. Digitisation comes into AEC companies in many aspects. The way people interact with each other in a company and with clients is ever changing. It is now possible to make contact with people who are thousands of miles away in different continents. It is possible to have people from all across the globes working on a collaborative project and develop documents and presentations without having to actually meet. Digitisation has advanced the whole world in many aspects with many new inventions and creations. The fourth industrial revolution is starting to hit the ground running and it can be argued that digitisation is the cause of this. Nobody can say for sure when the digitisation will slow down or what the next industrial revolution will be but one thing for sure is that it isn't slowing down any time soon.

2. Objectives

The title of this project is: investigating the implementation of enterprise 2.0 into AEC companies by looking at the different software and services on the market. Extensive research will be carried out into the different social software platforms already in use. For data/documentation sharing, the service Google will be looked into for the main part as they offer a vast number of services such as Google Drive and Google Docs, as well as many other applications that can easily be installed. Another piece of software that will be explored is Dropbox. For the communication and networking part of enterprise 2.0 the most popular forms of social media will be investigated, such as Facebook and WhatsApp and seeing if these could be implemented into companies and seeing what the advantages and disadvantages of these are because they are so integrated into everyday life. To get a better understanding of enterprise 2.0 an investigation will be carried out to see if there are any use cases and how enterprise 2.0 was implemented in these situations and also how a company could implement the software if they weren't up to date.

3. Social Software

3.1. Document/Data Sharing

3.1.1.   Google

The main software being researched into is Google and the applications it offers. The story of Google started in 1995 when Larry Page and Sergey Brin met in Stanford University and together created a search engine called Backrub which used links to determine the importance of individual pages on the World Wide Web. It wasn't until 1998 that Google Inc. was created. Larry and Sergey had a mission "to organize the world's information and make it universally accessible and useful." [1] As of February 2016, there were over 1 billion users which had access to the applications. These applications include Gmail, Google Drive, and Google Docs etc. Some lesser known applications would be Groups and Meet where you can collaborate with other users.
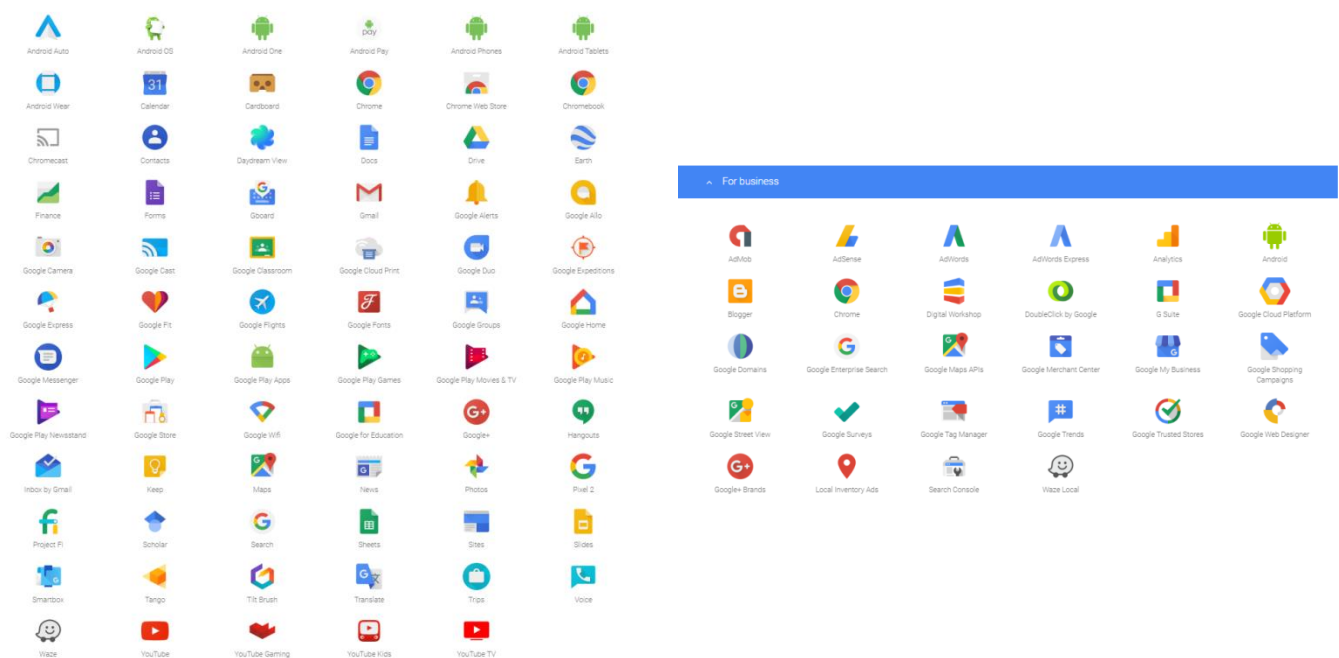

<div align="center">

Figure 1 - Google Applications [2]

</div>

The above left picture depicts the amount of different applications that are available to every day users and the picture to the right shows the applications specifically designed for business use.

While there are many applications on offer, not all of them are well known or used as much as a certain few. The main applications the everyday user uses can be shown in figure 2 below. It can be seen that a number of them could be implemented into an AEC company. Google offers a number of applications for document sharing and collaboration. Docs, Sheets and Slides are a word processor, a spreadsheet and a slideshow presentation program respectively. The applications can be used online and on a mobile. The good thing

about these applications is they allow users to create and edit files online while collaborating with other users in real-time. Edits are tracked by users with a revision history presenting changes. An editor's position is highlighted with an editor-specific colour and cursor. This would be very beneficial in a company as people working on the same project could work together without having to be in the same vicinity as each other. While the three applications offer good collaboration services, some users noticed that they don't offer the same types of functionality when compared to the Microsoft Office versions but found them relatively easy to use.
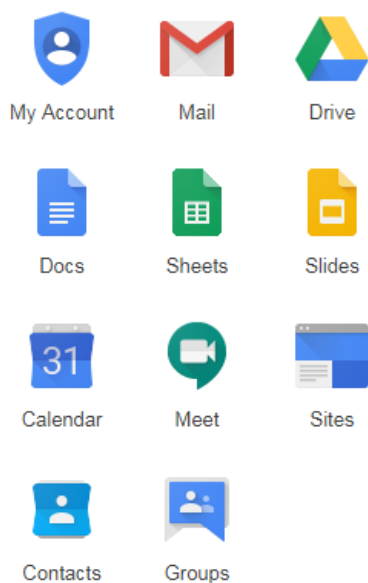

Figure 2 - Main Applications for everyday users [2]

Along with Google Docs, Sheets and Slides; Google has a file storage system called Google Drive. It allows users to store files in the cloud, synchronize files across devices, and share files. Like the three document applications there is a mobile and web application so users are able to see shared documents on the go.

For communication services, the mail application can be used to contact the whole company as well as the calendar keeping everyone up to date on events and projects going on. For a more social aspect in the working environment, there is an application called Google+ which is an internet based social network. It allows for users to create their own profile and interact with circles and communities of people meaning people working on the same projects would easily be able to interact and share ideas and solutions. Tied to Google+ is another feature called Google Hangouts which enabled users to chat, voice, and video conference between users. Google Hangouts is specifically designed for video and phone calls and messaging while Google Meet is a more enterprise friendly version.

All of the applications mentioned above are all included in Google's "G-Suite" which is a set of intelligent apps including Gmail, Docs, Drive and Calendar to connect the people in a company, no matter where in the world they are, from Google Cloud [3]. With Gmail, Calendar, Google+ and Google Meet it is easy to keep everyone up to date and you are able to meet workers or customers no matter where you are. This would be a huge advantage to AEC companies due to the fact that meetings are able to take place at any time thus increasing work productivity and shortening the time waiting for projects to progress. People are able to create documents very easily with Docs, Sheets and Slides which was explained earlier and can be easily edited by a number of different people. There are a few other applications that can be used as very useful collaboration tools such as "Keep" and "Jamboard". Keep allows users to easily collaborate with colleagues on notes, lists, photos, audio, and drawings. The user is able to capture brainstorming ideas quickly, keep them on

hand while you work, and watch to-dos get checked off in real time [4]. Jamboard allows users to sketch ideas onto a whiteboard-style on a 4k display. The user is able to drop images, add notes, and pull things directly from the web while collaborating with team members from anywhere. Both of these applications can be used in real time and at any time which would enable an increase in work efficiency, as well as, being able to get ideas from co-workers who wouldn't necessarily work in the same circles, thus arriving at solutions to problems and projects quicker than without any teamwork.

As discussed earlier, the storage application used is Google Drive. With the G-Suite, businesses can avail of unlimited cloud storage. With Team Drives, it is possible to keep all your team's work is stored in safe, easy-to-manage shared spaces. Any files added to Team Drives are owned collectively by the team, so everyone stays up to date. You are also able to keep files private until you decide to share them. Other features involve avoiding multiple versions and file merging by granting others permission to download, edit, comment, or view and you can also give shared files an expiration date. An application called Cloud Search which is like Google Search but it is built specifically for G-Suite. You are able to search through emails, docs, events, the corporate directory, and more to find whatever you're looking for, wherever it's located. The company directory makes it is possible to reach people faster as well as having a number of options to contact them with a click of a button [5].

The G-Suite offers a lot of security and control. There is a centralized administration which makes setup and management fast and easy. You can add and remove users, set up groups, and add security options like 2-step verification and SSO. A 24/7 help line is available to be able to assist if there is any arising issues. This can be coupled with the Mobile Management. There is a risk that with workers doing work on the go on tablets and phones, they could lose them and leak documents. With mobile device management (MDM) you can require screen locks, strong passwords, and erase confidential data with device wipe or selective account wipe for Android and iOS [6].
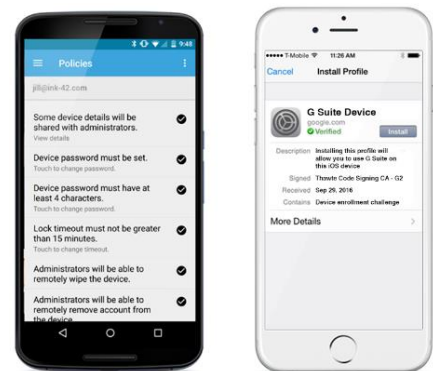

Figure 3 - Google's Mobile Management [6]

With the many applications that G-Suite and Google have, it is clear that they have a lot to offer to a company that will not only improve the work environment but also help the company evolve and expand in the future.

3.1.2. Dropbox

The next product that was researched was Dropbox. Dropbox is a file hosting service which offers cloud storage, file synchronization, personal cloud, and client software. As of March 2016, 500 million people around the world are able to use Dropbox to work the way they want, on many devices, wherever they go. Alongside this, there are 200,000 businesses on Dropbox Business [7]. Dropbox is similar to the Google application, Google Drive. While Google Drive focuses on collaboration and real-time editing, Dropbox is a cloud storage service. When comparing the two, a number of factors were considered, such as cost, amount of storage, collaboration, mobile access, web apps, real-time editing etc. The main ones at focus for this report are cost, amount of storage, collaboration and mobile access.

The pricing for G-Suite starts from as little as €4 per user per month which offers 30 GB of storage. This provides users with use to a number of the applications described above, such as, Gmail, Calendars, video/voice conferencing, etc. The best value package according to Google comes at a cost of €8 per user per month which offers unlimited storage. This comes with everything the basic package has to offer as well as the Cloud Search and audit reports tracking user activity [8]. The basic package for Dropbox starts at €10 per user per month with 2 TB of storage. It provides two-factor authentication and 256-bit AES encryption, but customer support is only available via email. Dropbox's best value package is €15 per user per month which offers unlimited storage [9]. So it is clear to see that G-Suite offers better value for money for a business.

A cloud storage provider shouldn't just make sharing files easy with other users; it should also allow users to choose different accessibility levels, so their data is safe even when sharing files. The major downfall to Dropbox is that you have to be a user to edit documents so if a client would like to update documents outside the company, they would have to sign up themselves. Whereas, for the G-Suite, any guest user can edit a document without forcing them to sign up. There is also an option to prevent shared users from downloading a file or sharing it with more users via email. Both services allow users to share files and folders either by entering a recipient's email or directly sharing the file/folder link. So based on the fact you don't have to be an existing customer to edit documents, G-Suite edges Dropbox.

As a lot of people would be able to work off a smart phone or a tablet, the mobile access of both services was looked at. Both services are very similar as they resemble their corresponding web applications. Users can view uploaded files or folders, or upload a new one just like the web application. However, it isn't possible to edit documents on either service unless you have a different application (Microsoft Office app for Dropbox and Google Docs for Google Drive). So in this situation it is a tie between the both of them.

3.2. Networking/Communication

3.2.1. WhatsApp

WhatsApp is a cross-platform instant messaging service for smartphones where it uses the internet for a range of services such as video calls, document sharing, sending text messages, etc. [10] It was founded in 2009 by Bria Acton and Jan Koum. As of February 2016 it had a user base of 1 billion people.

With WhatsApp you are able to instant message any of your contacts as well as create group chats, which is good for collaboration. This is coupled with being able to voice and video call people even if they're in a different country. You can send documents up to 100 MB which is very helpful if you would like a colleague to see a document straight away instead of emailing them. The messages and calls are secured by end-to-end encryption so only you and the person you're communicating with can read or listen to them. One thing that stands out about WhatsApp is the ease of syncing between a phone and a computer meaning that working on the go or in the office is easy [11].
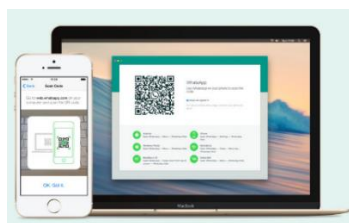

Figure 4 - WhatsApp Mobile and Laptop Sync [12]

When comparing it to the G-Suite service, there are a couple of applications that are similar. The application Hangouts Meet offers the user voice and video conferences. Unlike WhatsApp, Hangouts Meet can be connected to the Calendar application so it is quick and easy to connect to a meeting or set up a conference with clients. With Hangouts Meet, you can have video calls with 30 people whereas on WhatsApp, you can share between up to 256 people at a time. If a business were to upgrade to the enterprise version of Hangouts Meet then every meeting automatically includes its own dial-in details meaning guests can dial in quickly with just two taps on their smartphone. The good thing about Hangouts Meet is that you can share the same link with all meeting participants, making it easier to get everyone you need on the call.

Hangouts Meet is tailored towards video and voice conferencing for businesses. There is specifically designed hardware to make meetings a lot easier and smoother. Unlike WhatsApp where everything is kept in the one application, you would have to use a different application to collaborate with in the G-Suite. There are many applications on offer which have been discussed previously so this shouldn't cause too much stress to users having to switch between applications. While WhatsApp offers everything in the one application, the G-Suite applications seem far more superior and are more fitted to a business's needs.

3.2.2. Facebook

Facebook is an online social media and social networking service created in 2004. It was first available just in America as a student directory featuring photos and basic information but can be accessed now in 140 different countries. As of June 2017 there are 2 billion users worldwide making it one of the world's leading social networking sites.

Figure 5 - Facebook Network [13]

When comparing it to the G-Suite, the application it would compare with is Google+ which is a social network created by Google. With Facebook you are able to create events where people will get updates as to what other users are posting. Groups can easily be created which is very helpful for group work, however, they aren't very collaborative friendly. The benefits of the groups is the instant messaging side meaning if a worker has a problem in the company it would be answered relatively quickly. In the groups it is possible to add documents, photos and videos as well as create events for the corresponding users in the group. For Google+ it is possible to create posts and comments as well as creating a Community, which are groups created on a specific subject.

While Facebook, if used purposefully, can be a great tool to have and would be very beneficial for businesses because of the large number of users, it is an example of how the social aspect of enterprise 2.0 can be a problem. The average user will spend 35 minutes a day on Facebook [14] making it a big distraction. It has the potential to falter peoples work ethic and decrease efficiency overall in the company. While Google+ also has these problems, they aren't as prevalent due to the fact that it is specifically designed for business use. Using the G-Suite Google+, the company owner can control employee access to public content with options ranging from fully public to fully private and being able to choose whether employees can interact with public content within the company network.

While it would be hard to implement Facebook into a company due to the disadvantages, it does highlight some of the advantages social media can have. It shows how easily people are able to connect with one another across the world. While a company couldn't use Facebook for enterprise 2.0, it could use Google+ and have its own internal company network through it.

4. Use Cases

While carrying out an interview with Harvard Business Review, Andrew McAfee discussed how while conducting research for his book he discovered that the US intelligence community was the perfect example of a company implementing some sort of enterprise 2.0 service. The US intelligence community is a federation of 16 separate government agencies that work separately and together to conduct intelligence activities to support the foreign relations and national security. After the events of 9/11, it became apparent that they were failing in some very important ways to keep the country safe. Through his research, Andrew McAfee found out that parts of the system were blinking red in the weeks and months leading up to 9/11, no one was able to connect the dots among all the available pieces of intelligence. In the wake of 9/11, they deployed a 2.0 tool kit that spanned all 16 agencies. So for example, there is now a single Intellipedia wiki that goes across all 16 agencies. There is a uniform blogging environment, so if a worker is blogging away inside the FBI, someone inside the NSA or the CIA can automatically see when they are doing. They deployed Google search on top of all these as well, so search there works like search does on the big, broad web. Also, it was found that the most common benefit that people talked about with these new tools was the ability to find a colleague. Not even so much a piece of information, but the pieces of information were pointers to colleagues who would be great for whatever task was at hand. Even though it would be hard to predict that if these changes were implemented before 9/11 then it could have been avoided but it can definitely be said that there is a much better protection service there than before. [15]

5. Implementation

In a business there are many ways to introduce new methods into the company. Some involve diving head first and introducing it from the outset while others could take up to a year with slow implementation. The method of implementation that was thought would be most beneficial to social software is Six Sigma. Six Sigma is a methodology used to improve business processes by utilizing statistical analysis rather than guesswork. This proven approach has been implemented within a myriad of industries to achieve hard and soft money savings, while increasing customer satisfaction [16]. The methodology that will be specifically looked at is DMAIC. The definition of the project would be the implementation of the software. How the company then uses the software would be measured and then analysed to see how it can be improved. Once it is improved it would be controlled while simultaneously analysed to keep on track of any improvements. As the software would be

Figure 6 - Six Sigma Process [20]

constantly used there will be ways to improve on what is already there and as nothing is perfect, there will be some form of errors that will have to be ironed out to make sure that the software is running as smoothly and efficiently as possible.

6. Problems

6.1. Security

One of the biggest problems that can be seen in enterprise 2.0 is the security issues. There are constantly instances of security issues cropping up in the world. GM has had two ex-employee's copy 40 million dollars of hybrid research documents and take them to a competitive Chinese car manufacturer. The healthcare industry, worldwide, constantly has to report lost and stolen laptops and storage devices littered with documents and emails containing private health information (PHI).

With the social side of the software there's the risk that someone's going to post inappropriate content that somebody else in the company will find offensive. There's also the risk that someone is going to use the tools to harass a co-worker, or to just have an outburst about how much they don't like about their job.

Furthermore, hackers are becoming more and more prevalent so without the correct security on documents, they could be easily obtained and leaked. There's the threat that information that needs to be contained could be spread widely by either someone in the company leaking them or there being a fault within the software that publishes the undisclosed documents.

6.2. Big Data

The term 'Big data' describes a large amount of data which floods a business on a day to day basis [17]. Big data can be described by certain characteristics outlined below: [18].

Volume   This is the amount of data created and stored. The size of the data decides whether or not it is actually big data.

Variety   This is the type of the data. Knowing the variety helps people who analyse it to effectively use it.

Velocity   This is the speed at which the data is generated and processed to meet the demands.

Variability This is how much the data changes. Inconsistency of the data set can impede processes to manage it.

Veracity   This is how accurate the data is. Data quality of captured data can vary greatly, affecting the accurate analysis

While big data is not necessarily a huge problem, if it is not stored and analysed correctly then it can create a problem. The largest big data practitioners are Google, Facebook, Apple, etc. For big data storage it is important that it will be able to handle very large amounts of data and will also be able to deal with the growth of data. It will also have to provide an input/output operation per second that will be able to deliver data to analytics tools [19].

7. Conclusion

Enterprise 2.0 is fast being implemented into many companies and any company that doesn't find some way of implementing into their business could find themselves being left behind in this ever developing world in the future.

There is most certainly a huge amount of technology and services out on the market that would help a company with its development with enterprise 2.0. However, not all of them have the full capabilities that would be able to get the maximum out of a company. As highlighted in the report, Dropbox is a file hosting service which offers cloud storage, file synchronization, personal cloud and client software. This means that it only offers part of what would be needed to improve a company. The same applies for WhatsApp and Facebook. All three services offer only part of the solution. Nevertheless, they all give a good insight into the types of software and technologies on the market.

Google offers all of the applications to help a company implement enterprise 2.0, especially with its "G-Suite". It not only offers good data sharing and collaboration tools, it also has a number of applications for communication and networking. All of these applications can be integrated with each other to offer companies and corresponding employees the chance to not only improve the company but also themselves personally with all of the information easily accessible and secure within the service. Additionally, it can be seen that it is very easy to introduce other people into the certain aspects of the service without revealing any important information about the company meaning it is also very useful for collaboration with clients. Overall, it is clear that the G-Suite meets the definition of enterprise 2.0 – "*Emergent social software platforms within companies or between companies and their partners or customers*" making it an excellent candidate to be implemented into a company.

8. References

[1]   Google, "Our story: from the garage to the Googleplex," Google, [Online]. Available: https://www.google.ie/intl/en_ie/about/our-story/. [Accessed 31 October 2017].

[2]   Google, "Google Applications," Google, [Online]. Available: https://www.google.ie/intl/en_ie/about/products/. [Accessed 31 October 2017].

[3]   Google, "G-Suite," Google, [Online]. Available: https://gsuite.google.com/together/?user-benefits_activeEl=connect. [Accessed 01 November 2017].

[4]   Google, "Keep," Google, [Online]. Available: https://gsuite.google.com/products/keep/. [Accessed 01 November 2017].

[5]   Google, "Cloud Search," [Online]. Available: https://gsuite.google.com/products/cloud-search/. [Accessed 15 November 2017].

[6]   Google, "Mobile Management," [Online]. Available: https://gsuite.google.com/products/admin/mobile/. [Accessed 15 November 2017].

[7]   Dropbox, "Dropbox," Dropbox, [Online]. Available: https://www.dropbox.com/about. [Accessed 31 October 2017].

[8]   Google, "G-Suite Pricing," [Online]. Available: https://gsuite.google.com/intl/en_ie/pricing.html?tab_activeEl=tabset-companies. [Accessed 15 November 2017].

[9]   Dropbox, "Dropbox Pricing," [Online]. Available: https://www.dropbox.com/business/pricing?&_tk=sem_b_goog&_camp=sem-b-goog-uk-eng-top-exact&_kw=dropbox|e&_ad=213110110699|1t1|c&gclid=CjwKCAiA6K_QBRA8EiwASv tjZfATknaPLEuy0_l9_p5uI-Cq8oaL78zE-mURCeBKAjfZ9iFy4qLprhoCkdIQAvD_BwE. [Accessed 15 November 2017].

[10]   WhatsApp, "About WhatsApp," WhatsApp, [Online]. Available: https://www.whatsapp.com/about/. [Accessed 31 October 2017].

[11]   WhatsApp, "Features," WhatsApp, [Online]. Available: https://www.whatsapp.com/features/. [Accessed 16 November 2017].

[12]   Apple, "WhatsApp Desktop," Apple, [Online]. Available: https://itunes.apple.com/us/app/whatsapp-desktop/id1147396723?mt=12. [Accessed

16 November 2017].

[13]   All4Desktop, "Facebook World Network," [Online]. Available:
       http://all4desktop.com/4170362-facebook-world-network.html. [Accessed 16
       November 2017].

[14]   Adweek, "How Much Time Will the Average Person Spend on Social Media During
       Their Life?," Adweek, 22 March 2017. [Online]. Available:
       http://www.adweek.com/digital/mediakix-time-spent-social-media-infographic/.
       [Accessed 16 November 2017].

[15]   S. Green, Interviewee, *How Enterprise 2.0 Will Reshape Your Business.* [Interview]. 4
       December 2009.

[16]   S. Sigma, Six Sigma, [Online]. Available: https://www.6sigma.us/six-sigma.php .
       [Accessed 25 September 2017].

[17]   SAS, "Big Data," [Online]. Available: https://www.sas.com/en_ie/insights/big-
       data/what-is-big-data.html#. [Accessed 15 November 2017].

[18]   M. Hilbert, "Big Data for development," 3 January 2015. [Online]. Available:
       http://www.martinhilbert.net/big-data-for-development/. [Accessed 15 November
       2017].

[19]   A. Adshed, "Big Data Storage," April 2013. [Online]. Available:
       http://www.computerweekly.com/podcast/Big-data-storage-Defining-big-data-and-
       the-type-of-storage-it-needs. [Accessed 15 November 2017].

[20]   B. Leader. [Online]. Available: http://www.bpmleader.com/2013/06/07/why-bpm-
       and-lean-six-sigma-lead-to-process-automation/. [Accessed 14 November 2017].