Increased productivity in the construction industry using smartphones and tablet computers

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B.Sc. in Construction Management

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Abstract

The need for productivity in the construction industry has become even more important in recent years with the economic downturn. The management of information is central to improving productivity. Smartphones and tablet computers can provide a construction professional with instant access to and editing of information.

The construction industry has been slow to adopt new technologies. There are a number of reasons for this; for example, typically the older generation make up the key decision makers and it is this generation who will be slower to adapt new technologies.

This research reviews the potential for smartphones and tablet computers to improve productivity in the construction industry, and examines the obstacles that companies will face in adopting the technology. The current use of smartphones and tablets in the construction industry in Ireland, and abroad, has been researched and compared with examples of usage by other industries.

In order to complete the objectives in an impartial manner the author used the following sources of research:

- An examination of the literature published in relation to smartphones and tablet computers
- Questionnaire, to estimate the current use of smartphones/tablets, and to attain professional's current view of the technology.
- Semi-Structured interviews with industry professionals
- Case Study, to demonstrate how the technology could be used on site
- Seminar: Mobile Apps in the Built Environment

Smartphones and tablet computers provide an opportunity for the construction industry to improve its practices, and therefore its productivity. However there is insufficient research and minimal literature that demonstrates the benefits of these relatively new technologies to the industry. This dissertation demonstrates how the industry can benefit from a more widespread adoption of the technology.

Declaration

I hereby certify that this work, which I now submit for the assessment on the programme of study leading to the award of a Bachelor of Science in Construction Management, is entirely my own work and has not been submitted for assessment for any other academic purpose.

Signed: _____   Date: 17/04/2012

Acknowledgements

I would like to thank my parents, family, and friends for their support over the years. I would also like to thank Ruairi Hayden, my supervisor, for his guidance.

Finally I would like to thank those who took the time to take part in interviews, those who completed the questionnaire, the lecturers in the Department of Construction Management and Technology, my fellow students, and the librarians at Bolton St.

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List of Acronyms

ICT   Information and Communications Technology

IT   Information Technology

COMIT   Construction Opportunities for Mobile Information Technology

FIATECH   Fully Integrated and Automated Technologies for Construction

APPS   Applications

PDA`S   Personal Digital Assistants

UK   United Kingdom

US   United States

BIM   Building Information Modeling

CHAPTER 1: INTRODUCTION

1.1 Introduction

"The developments will be in making the products more and more portable, networking them, getting out laser printers, getting out shared data bases, getting out more communications ability, maybe the merging of the telephone and the personal computer." **Steve Jobs, 1987.**

The above quote, as discussed by Macyourself.com (2011), shows us how Steve Jobs (the co-founder of Apple Inc.) predicated that portable computing would become widespread in the future.

The figures listed below demonstrate how these technologies are embraced in society today.

1. 57 % of Irish workers travel with a smartphone and 10% carry a tablet computer. As reported by silicon republic (2011).
2. 62% of adults aged 25-34 in the United States own a smartphone. Research by Nielson (2011).

The construction industry can be seen by certain areas of society as backward or somewhat behind the times in terms of embracing information and communications technology (ICT). This project will examine the use of smartphones and tablet computers in the construction industry.

1.2 Aim

The aim of this research project is to ascertain to what extent smartphones and tablet computers have been used in the construction industry in the past, how they are being used today, and how they will be used in the future. It will establish how smartphones and tablet computers can aid a construction company's productivity.

1.3 Objectives

A. To determine the current use of smartphones and tablet computers in the Irish construction industry and compare this to the construction industry in other countries.

B. To examine the key uses and productivity benefits of smartphones and tablet computers in the construction industry.

C. To examine the use of smartphones and tablet computers in other industries, comparing this with the construction industry.

D. To critically analyse surveys, questionnaires and interviews carried out during research.

1.4 Ethics

The author obtained permission from the interviewees to record and analyse the proceedings of the interview as part of this research. With regard to the online questionnaire individual respondents were not tracked which ensured confidentiality.

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1.5 Chapter Summaries

Table 1.1: Chapter Summaries		
Chapter 1	Introduction	This chapter introduces the topic and states the aims and objectives of the research.
Chapter 2	Literature Review	Analyses and summarises literature available and identifies gaps that the research aims to address.
Chapter 3	Methodology	Discusses the methods of research used by the author.
Chapter 4	Case Study	Demonstrates ways in which smartphones and tablet computers could be utilised on a construction site.
Chapter 5	Research Findings	Summary of findings from interviews, questionnaires and the seminar.
Chapter 6	Discussion of Research Findings	Interprets the research findings and the correlation between them.
Chapter 7	Conclusion and Recommendations	Discussion of the findings of the research, and recommendations for further research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Literature has been compiled from various sources; such as websites, company publications, books, newspaper articles, research papers, conference proceedings etc. Both primary (original, factual) and secondary (interpretive) sources of literature have been examined. The author has examined literature regarding the following topics:

1. The construction industry before ICT.
2. The current use of ICT in the construction industry.
3. The current use of smartphones and tablet computers in the construction industry.
4. Outlook for the future of smartphones and tablet computers in the construction industry.
5. Barriers to the adoption of smartphones/tablets in construction.
6. The use of smartphones and tablet computers in other industries.

The author has summarised the literature examined and identified a need for further research.

2.2 The Construction Industry before ICT

The construction of structures has taken place long before ICT came to fruition. Structures have been built in prehistoric times, such as wooden logs over streams, huts, and shelters. More recently, and more famously, the three pyramids of Giza were built, approximately 4500 years ago.

When discussing pioneering designers from the period before ICT, Howard (1998, p.24) asks and answers the rhetorical question:

> *If these great men had used the technology available to us at the end of the century, might they have become obsessed with the computers themselves? I would prefer to think that, having the power to solve some of their problems, their creativity would have been even greater.*

Structures have been built for tens of thousands of years, and they were all built without the benefits of ICT which only came to fruition in the 20th century. However

all companies seek maximum productivity and profits; this is where ICT can be beneficial in today`s construction environment, which is essentially the point that Howard was making.

2.3 Current use of ICT in the construction industry

Dibkas *et al.* (2010, p.3) comment that *'construction lags behind other major industries in the adoption of information technologies due, in large part, to the highly fragmented nature of the industry'.* The author argued that the very nature of the construction industry does not immeadiately lend itself to ICT, particularly amongst subcontractors who carry out the actual works on site. This is a view also shared by Hore (2006).

Dainty *et al.* (2006, p.192) outline three ways in which Information Technology has changed the way information and communications is managed in the construction industry; by speeding up the process of information, making information more accessible, and by improving management information systems. Smartbuilder Software Ltd (2011) has noted that management staff, in particular construction managers and engineers, spend a lot of time on site; and are therefore out of touch with IT systems in the site office.

2.4 Use of smartphones and tablet computers in the construction industry today

There have been a number of applications made for construction industry professionals for the iPad and iPhone. Such applications have been discussed by constructionweekonline.com (2010) and similarly by Patel (2011).

Several companies offer fully functional software available on smartphone or tablet devices to carry out tasks in the field, for example, SmartBuilder Software Ltd (2012), Senubo (2012), Aconex (2012), Ennova (2012) and Zutec (2012). These programs are

typically web based, backed up to cloud computing storage, and can be collaborated with desktop software.

There are numerous tasks that can be carried out in the field by construction professionals, this is a view shared by SmartBuilder Software Ltd (2011) and Builder MT (2012). Apple (2012) outlines eight different categories of business tasks, applicable to any industry, which can be carried out on its iPad from anywhere.

Smartphones and tablets have been embraced by certain companies in recent years. Ozinga (2011, quoted in Van Hampton, 2011), talked about using his iPad to provide clients with instant quotes, sign off on transactions, plan concrete pours, and track the company`s mixing truck; he is quoted as saying:

> *In the past, a customer on-site would ask you `Where`s my truck?' And a typical response you would have to give is, `It`s close by, it has left the plant, it`s on the way` Now, you are not left in the dark.*

Similarly, Parker and Morrison (2011) discussed productivity benefits using tablet computers for a construction consulting company called D7; *'tasks that took a week or longer can now be done the same day'*.

Research was carried out by Pawsey and May (2012) regarding the current use of Mobile IT in the construction industry. Mobile IT devices were split into three categories; laptops, rugged devices, and other i.e. smartphones and tablet computers. Respondents to a survey were asked to indicate whether they carried out certain tasks using mobile devices and the responses were grouped by professional category.

For example, there were numerous responses from Site managers and Site Engineers indicating that they used smartphones and tablets for tasks such as taking photographs (approximately 21 from a total of 60 responses), electronic communications (15 from 60 responses), accessing the internet for information (14 from 59 responses) and taking general notes (14 from 55 responses). Typically there were less than five respondents from the same category who indicated that they used the devices for more complex activities such as the recording of site deliveries, progress, inspections, and health and safety monitoring.

2.5 Outlook for the future

Smart Builder Software (2011) believes that the use of smartphones and tablets in construction will increase in the next few years. Hore (2007) shares a similar view in the sense that he believes that ICT, if harnessed properly, has the potential to improve processes and solve problems in the industry. Stinson (2011, quoted in Van Hampton, 2011) said: *"It really looks like the tablet may be one of the enabling devices that allow [the industry] to make that leap forward"*

Research carried out by Fiatech (2012) also advocated the potential uses of these devices. Sixty to seventy per cent of respondents to its survey agreed that smart devices (such as iPads and Android devices) can be valuable for project control activities in the construction industry. There were 15 different project control categories including craft coordination, tracking labour productivity, tracking use of equipment and construction photo management.

2.5.1 The use of BIM in conjunction with smartphones/tablet computers

A conference was held by COMIT in 2011 titled "*Construction Mobile IT Conference 2011 - Delivering the value of BIM to Smart Mobile Devices."*
Slides were released from a presentation given by Kalp (2011) who demonstrated how a QR code could be placed on a drawing. This code could be scanned by the user with a smartphone or tablet computer. Information would then be displayed on the device such as details regarding updates to the drawing, clarifications, changes etc.

Figure 2.1: QR Code

COMIT (2011) also gave a presentation which discussed the possibility of integrating BIM on mobile devices by carrying out tasks such as progress reports, snag lists, and equipment checklists.

2.6 Barriers to the adoption of smartphones and tablet devices

Respondents to a survey carried out as part of research undertaken by Pawsey and May (2012) indicated barriers to the adoption of mobile IT in construction, the main ones being:

- Fears over work/life balance being adversely affected by *"stress due to continuous accessibility"*
- Poor connectivity on site, with wireless networks not available
- Price
- Distraction from other works
- Short lifecycle of devices

2.8 Smartphones and tablet computers in other industries

Airline Industry

According to zdnet (2011), the federal aviation authority has approved iPads for use on American Airline flights, which can replace the need for hefty paper manuals. Tablet computers being used in such a high risk environment for important tasks demonstrates the far reaching potential of this technology.

Banking Industry

As outlined by The Irish Times (2011), Allied Irish Banks launched a mobile banking site will allows customers to access their accounts online, which is a business to customer focused move. Such offerings by business`s are vast in quantity, and are changing the way business in carried out.

Healthcare Industry

As outline by TabTimes (2011), Ottawa hospital, which has close to 12,000 employees, now owns 3000 iPads. This represents a huge endorsement of the benefits of the technology.

Newspaper Publishing

As outline by CNN Money (2011), Gannett, the largest US newspaper publisher when measured by circulation, has purchased thousands of smartphones and tablet computers for its journalists.

2.9 Synthesise literature

The author has examined literature which reflected on the construction industry before the onset of ICT, considered how construction can take place without the benefit of ICT, and concluded that ICT can increase productivity in the industry.

Literature that summarised the traditional use of ICT in the industry was reviewed which set the scene for the analysis of literature regarding the use of smartphones and tablet computers in the construction industry today.

It is clear that many construction companies can see the benefit of using smartphones and tablet computers from the analysis of companies who currently provide dedicated construction software for these devices. It was also reported that there are many applications available for download for devices which can be used by construction professionals to increase their productivity.

Research carried out by COMIT was analysed. The research provided feedback from the industry on the usage of mobile IT in general to carry out tasks. This research also highlighted optimistic and sceptical views from experts towards the technology. The integration of BIM on mobile devices was examined using presentations from a seminar held by COMIT.

Literature was examined which demonstrates how companies from varied industries are embracing smartphones and tablet computers.

2.10 Summary

The author identified a gap in the literature available regarding the current use of smartphones and tablet computers in construction. Much of the literature available is scattered across the internet and part of it is provided by companies who are selling a service.

Research was released by FIATECH in March 2012 regarding the use of mobile IT in construction, however, this research was in progress since 2007 and does not have any respondents from Ireland. Furthermore it does not concentrate on smartphones and tablets but on mobile IT in general which included laptops and traditional limited use PDA`s.

Through qualitative and quantitative research the author will address that gap through this work. This research is targeted specifically at smartphones and tablet computers and provides detailed and insightful comments from industry experts on the matter.

CHAPTER 3: METHODOLOGY

3.1 Introduction

A variety of research methods have been deployed. The various methods of research support each other with similar findings, which add credibility to the findings.

3.2 Research Procedure

The below diagram gives a snapshot of the principal methods by which the research has been carried out.

Method of Research

| Qualitative | Quantitative |

Interviews   Questionnaires   Seminar   Literature Review

Collection of Data

Analysis of Data
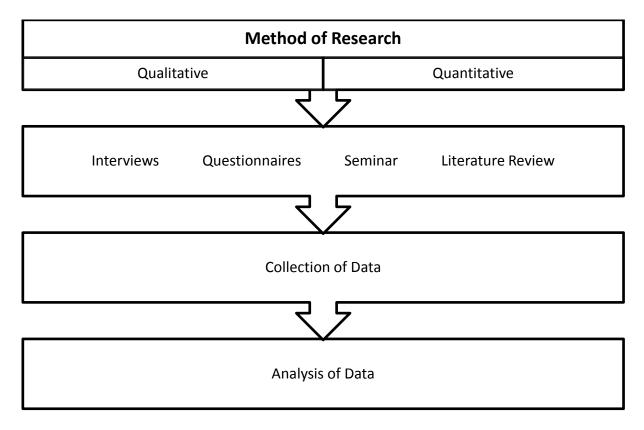
Figure 3.1: Research Procedure

3.3 Literature Research

The literature research has been compiled from primary sources such as newspaper articles, research papers, magazine articles and company websites. Secondary sources include conference proceedings and books. Owing to the fact that the use of smartphones and tablets in construction is a relatively new occurrence the literature available on the subject is limited; this work aims to address this gap.

3.4 The Case Study

A case study was developed in order to demonstrate how smartphones and tablet computers could be used in a real world scenario to aid productivity on a construction site. The case study is theoretical and demonstrates how tasks could be carried out on a site utilising smartphones and tablet computers.

The author draws on what they have learnt during their academic and working career in order to present a scenario which demonstrates to the reader a way in which smartphones and tablet devices can increase productivity on a construction site.

3.5 Qualitative and Quantitative Research

Qualitative and quantitative research was carried out in the form of interviews, online questionnaires and targeted questionnaires. The aim was to gain an insight from industry professionals regarding the use of and attitudes towards smartphones and tablet computers.

3.5.1 The Interview

Semi Structured Interviews were carried out with various construction professionals in order to represent their views on the potential for increased productivity using smartphones and tablet computers in the construction industry. The ability of the interviewer to probe and allow the interviewee to deviate the discussion away from a certain question was one of the main benefits of the semi structured interviews. Another benefit of interviews in general is the effect of body language; this affects both the responses of the interviewee and the probing questions asked by the interviewer.

Permission was obtained by the author from the interviewee to tape record the interviews. This ensured that crucial details were not missed, which aided the accuracy and objectivity in recording responses. The recordings were transcribed and analysed by the author to establish the key findings from the interview. The analysis of the interviews can be found in the research findings chapter and the transcriptions in the appendices.

Limitations to Interviewing

It is difficult to predict how the discussion will deviate during an interview. The author has endeavoured to engage with the interviewees and mediate between the interviewee`s comments and the author`s questions.

The Richard Mulvahy Interview

Richard Mulvahy is the Executive Chairman and Co-Founder of Smartbuilder Software Limited. Smartbuilder Software Limited offer a web based software system on the Android platform for managing quality and progress. The interview aimed to get an insight into how this company saw an opportunity in the construction market to increase productivity in this way. Richard, as co-founder of this business, is a firm

believer in this technology; the interview aimed to obtain their views on the benefits and obstacles facing the technology.

The Kevin Rooney Interview

Kevin Rooney is a Project Manager with Walls Construction. He has many years of experience with communications and administration on site. The aim of this interview was to gain an insight into Kevin's, and his colleagues, views on smartphones and tablet computers in construction.

The Alan Hore Interview

Alan Hore is a director of the Construction IT Alliance. This alliance was set up to encourage the Irish Construction Industry to take advantage of the potential of Information Communications Technology.

The interview aimed to capture the views of a professional who recognises the benefits of information technology in construction, and who is at the forefront of promoting the technology.

The Brendan O Riordan Interview

Brendan O Riordan is Business Development Manager for Zutec, who provide an online based system for access to project documentation. With regards to smartphones and tablets they have developed a system for recording snags which is being utilised in a major way in Qatar.

Brendan contacted the author after completing a questionnaire and suggested meeting to discuss the research and to demonstrate examples of the actual use of their software in the field. The author conducted an interview with the aim of finding out more about Zutec's offering and Brendan's views on smartphones and tablets in construction.

3.5.2 The Questionnaire

An online questionnaire was employed to examine the current use of smartphones and tablet computers in the construction industry, and to capture industry professional's views on the technology.

Questionnaire Audience

When considering the audience for the online questionnaire, the author employed the use of construction magazines and directories in order to identify the largest construction companies in Ireland, the United Kingdom, and the United States of America.

Irish Construction Industry Magazine`s (2010) publication *Ireland`s Top 100 Construction Companies 2010* provided the author with a list of companies to target the questionnaire with. The author found that many of these companies had since ceased operating.

When identifying companies in the United Kingdom for distribution, the author utilised The Construction Index`s (2011) publication *Top 100 Construction Companies 2011*.

Engineering News-Record`s (2011) publication *The Top 400 Contractors* provided the author with a list of construction companies in the United States from which to distribute the questionnaire; the author contacted companies within the top 100 from this list.

The author also utilised discussion groups on LinkedIn, the professional network. This platform allows members to start discussions in groups which fellow group members can see, respond and participate in. Examples of such groups include *TCN – the UK Construction Network* and *Texas Construction Experts.* Posting questionnaires on these groups allowed the author to sample construction professionals from around the globe whom otherwise would have been difficult to gain responses from. A full list of the relevant networking groups is included in the appendix.

Targeted questionnaires were sent to Paul Ozinga and Julian Clayton, whom the author had learned through reading an article by Van Hampton (2011) were utilising smartphones and tablet computers to complete tasks. The questionnaire asked the same questions as the main questionnaire however altered slightly to suit the respondent. Targeting individuals with a questionnaire gave the author an added dimension to the research.

Limitations to Questionnaire

Respondents to questionnaires may give answers which they believe may be expected of them. They may have decided that they would not like to express a particular view regardless of their true opinion. There is also the possibility that some respondents may interpret questions differently to other respondents.

The author initially distributed four separate questionnaires to Irish Main Contractors, Irish Subcontractors, United Kingdom Contractors and United States Contractors. In hindsight this made data analysis more time consuming, with responses combined carefully using Microsoft Excel. The author learned from this and the final questionnaire posted on LinkedIn professional networking groups included a question on demographics.

Questionnaire Design

The questionnaire was designed using Survey Monkey. The author found that this platform was user friendly. Downloading detailed reports of the results in many file formats was possible, along with filtering of the responses.

When compiling a list of questions, the main consideration for the author was asking questions that would help achieve the objectives set out in the project proposal. The questionnaire was instrumental in achieving the objectives set out in the introduction chapter.

The questionnaire was a mixture of qualitative and quantitative research. Questions were asked about people`s views on the benefits and pitfalls of smartphones and tablet computers in the construction industry, this falls under qualitative research.

With regard to quantitative research, questions were asked requiring yes or no answers. These were data orientated scientific questions. In some cases there were follow on questions to these which asked the respondent for further comments and this is considered as qualitative research. A summary of the key comments made by respondents is in the research findings chapter, all comments are included in the appendices.

The Questionnaire

The author introduced the questionnaire by stating the profile of the author, the details of the research, the aims of the questionnaire, communicating confidentiality and providing contact details.

Questions were asked regarding demographics, professional categories and company size. This allowed the author to compare the answers based on the aforementioned criteria. Respondents were then asked questions regarding their or their colleague's use of smartphones/tablets. They were asked their opinion on the benefits and the barriers of the adoption to the technology. Space was provided throughout the questionnaire for additional comments and the respondents were given the opportunity to indicate that they would like to receive the results of the survey. Further details on the design of the questionnaire are included in the appendices.

3.5.3 The Seminar

Whilst carrying out research the author learned of a Seminar called *"Mobile Apps in the Built Environment"*. This event was hosted in the Building Centre in London on the 27th March 2012. The author attended this event as it provided an opportunity to learn from industry experts about the productivity benefits of smartphones and tablet computers in the construction industry. The seminar was organised by Woobius (a

mobile app developer for the building industry) and included speakers such as Neil Pawsey from COMIT Projects Ltd (Construction Opportunities for Mobile IT).

3.6 Triangulation

Triangulation involves cross referencing the results of the different methods of research. The findings from the literature review, interviews, questionnaires, seminar and case study are summarised and compared in the discussion of research findings chapter. For example the findings of the literature review are supported by the questionnaire. The findings of the questionnaire are supported by the interviews and the seminar etc. The integration of the research methods provides more credibility to the research findings.
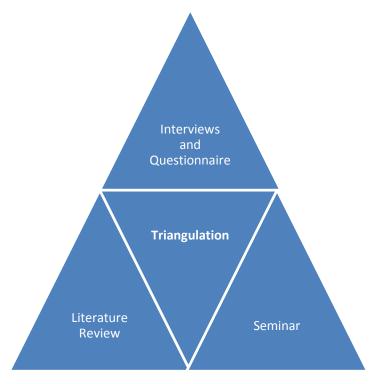
Figure 3.2: Triangulation

CHAPTER 4: CASE STUDY

4.1 Introduction
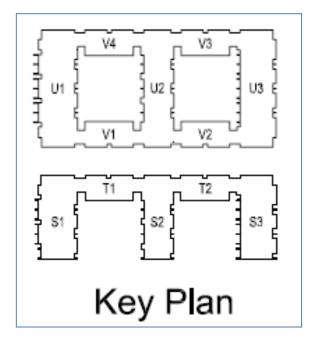
Figure 4.1: Spencer Dock Key Plan

The author chose the Spencer Dock Apartments development as a way of demonstrating how smartphones and tablet computers could be utilised to carry out administrative tasks in a seamless manner. The author is familiar with this site having been involved in a Quantity Surveying capacity including carrying out productivity reports.

The contract entailed approximately 40,000m2 of apartments consisting of precast walls and slabs with a concrete screed. This theoretical case study will show how smartphones and tablet computers could be utilised on site with reference to this project.

4.2 Applications created

An application is defined by PCMAG.COM (2012) as *"software that is used for business or entertainment"*. As a way of demonstrating how smartphone/tablet applications could be used on site, the author created three applications using Google's "Appinventor" software. These applications are very basic and are shown only as a visual example of how this technology can be used.

All of the following applications could be used without access to the internet. When the user is ready, they can upload the information to the companies servers, which would store information using cloud computing.

4.2.1 Snag List Application

This snag list application provides the construction manager with a tool to dramatically decrease the time spent completing snag lists. Figure 4.2 on page 25 shows a screenshot from the software.

Main Benefits of Application:

This system allows the construction manager to complete snag lists whilst on site and immeadiately send it to the relevant subcontractor.

Photographs can be taken with the device through the software and this photo will be included in the submission to the subcontractor.
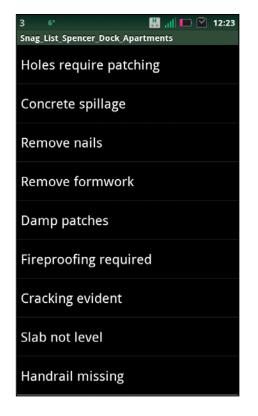
The paper trail will be reduced. Normally a snag list is completed roughly on paper by hand, and then it is transferred onto Microsoft word in the site office and emailed to the subcontractor. It is also then filed in the main contractors folders.

Having an electronic system reduces the number of steps in the process and reduces the amount of paper printed which is also better for the environment.

Clicking any of these buttons will display a list of choices from which the user will select. (As shown on Figure 4.3) This can be completed almost instantly.

Figure 4.2: Snag List Application Screenshot

Choices generated by choosing defect tab in Figure 4.2

Figure 4.3: Snag List Application Screenshot 2

The details regarding the tabs shown in Figure 4.2 are as follows:

Block	• Allows the user to select on which block the snag takes place • I.e. U1, U2, T2, S3 etc.
Floor	• 1st, 2nd, 3rd, Mezzanine etc
Room Number	• 1, 2, 3 etc. • Allows user to narrow down a specific area
Defects	• Detail of snag required (shown in Figure 4.3) • The user chooses from a comprehensive list of foreseeable snags
Description	• Allows the user to make additional comments or notes regarding the snag if required
Tag photo	• Ability to associate a photograph with the snag (from gallery or by using devices camera)
Category	• E.g. urgent, requires attention etc.
Status	• In progress, completed, overdue etc.
Notify Subcontractor	• Provides for the selection of the relevant subcontractor
Assigned by:	• There may be more than one individual on site, this section is used to note who carried out the snag
Upload to server (not visible in Figure 4.2)	• Allows user to upload the snag details to the companies servers/storage

4.2.2 Productivity report application

Keeping track of productivity on a large site can be a difficult task. The author was involved in this process at the Spencer Dock apartment development; it was a cumbersome task. It involved bringing drawings on site and marking up exactly what had been done, measuring the works in the site office, and consulting with the project manager to allocate work and labour in the correct areas.

In order to speed up the process, the author has proposed a system similar to the one shown in Figure 4.4. When the productivity report is due, the user can estimate the percentage of the preparation work complete for a particular pour and estimate the labour involved in consultation with the project manager. With the quantities calculated for a particular pour in advance this method can generate a productivity report in a streamlined fashion.

Whilst there may be slight discrepancies when using percentages on a week to week basis, over the course of a month the picture should become clear.

This concrete productivity report can be combined with other work elements such as back propping to give a picture for the entire contract.

The time that the quantity surveyor has saved in this scenario can be spent concentrating their efforts on agreeing payments with the client.

Figure 4.4: Productivity Application Screenshot

4.2.3 Concrete pre construction checklist

A concrete pre construction checklist as shown in Figure 4.5 can be carried out by the project manager whilst out on site. It would be possible to provide the client/architect with access to this programme to allow them to digitally certify their acceptance of the checklist.

The alternative to this is the traditional method whereby the paper form may be printed, scanned, and emailed from the contractor to the client and vice versa.
This programme reduces the number of steps in the process which will lead to an increase in productivity on site. This may be particularly useful on large projects such as the Spencer Dock apartments.

Cost savings may be difficult to quantify initially, but it stands to reason that anything that can quicken the process will lead to increased productivity which should result in cost savings for the construction company.

Figure 4.5: Checklist Application Screenshot

4.3 Other potential uses on site

There is a multitude of applications available for download on Android and Apple devices that can help construction professionals and tradesmen.
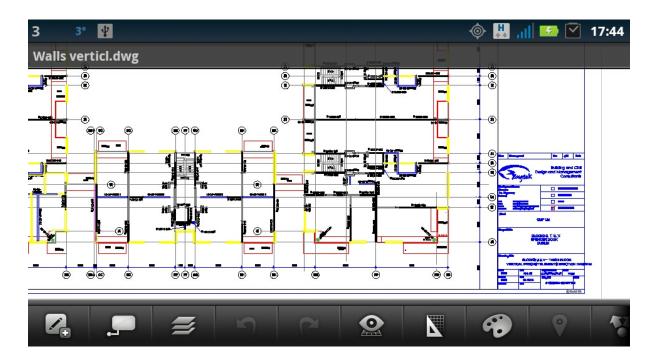
Figure 4.6: AutoCAD Application Screenshot

1. Viewing Drawings

The AutoCAD application allows the user to view and annotate drawings whilst on site. The screenshot above (Figure 4.6) shows a Spencer Dock drawing being displayed on the author's phone. However this is much more useful when used on a tablet device due to the larger screen size.

Figure 4.7: Worker struggling with drawings

Figure 4.8: Using tablet in lieu of drawings

Images courtesy of Smartbuilder Software Ltd (2011)

2. Using device to track delivery vehicles

    The Spencer Dock contract took delivery of concrete from across Dublin. If there is a delay with delivery, a tracking device would allow the construction manager to pinpoint the location of the vehicle so they can plan their activities in accordance.

3. Weather forecast

    There are numerous weather forecast programs available for smartphones and tablet devices. With Ireland's unpredictable weather it would be convenient to be able to keep track of the weather whilst on site as it can have an effect on works, especially wind.

Figure 4.9: Weather Forecast Application

(Screenshot above from author's phone)

4. Using smartphone/tablet`s internet connection as a wifi hotspot

    On the first few months of the Spencer Dock contract there was no internet on site due to problems in getting fixed line connections. Being able to access the internet with these devices would have solved this problem and improved productivity.

5. Construction Calculation applications

There are numerous construction calculation applications which can help a tradesman calculate quantities in a timely manner. With the wide variety of tradesmen and the quantities of work on the Spencer Dock contract, having a tool like this may have proved very useful for tradesmen.
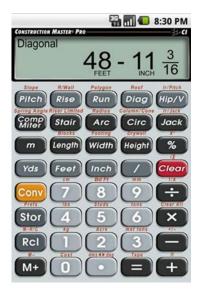
Figure 4.10: Construction Calculator

Calculated Industries (2012)

6. High Quality Camera

Smartphones today have much higher quality cameras than standard phones in recent years. Tablet computers also have high quality cameras. Being able to take photographs at a moment's notice is very convenient. Not requiring the use of a dedicated camera is convenient for the construction manager. On a site the size of Spencer Dock, many issues can crop up which require documenting and photographing; being able to do this immeadiately helps.

7. Cloud Computing

The three sample applications that the author created would require a way of storing the information. The information could be stored on the device; however, for the user's colleagues to access the information it would need to be stored in a central location.

For example, Drop Box (2012) currently offers 1000 GB of storage for five users for $795 per year and each additional user costs $125. This is a significant amount of storage which would be sufficient for most construction companies; certainly enough for a single contract such as Spencer Dock. Alternatively the companies who provide construction companies with software to record data on mobile devices may provide storage in the cloud as part of their service.
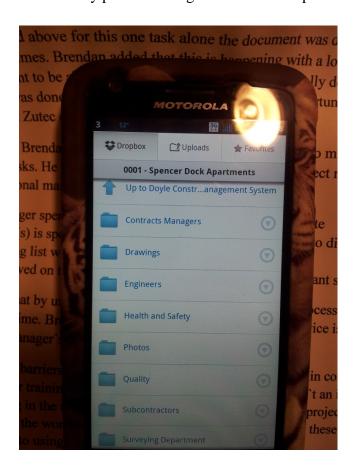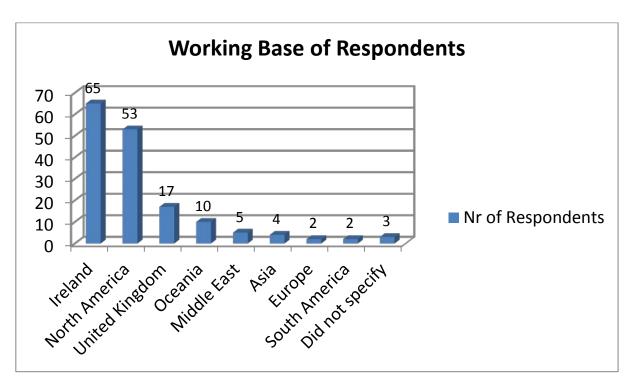
Figure 4.11: Drop box File Management System Spencer Dock

CHAPTER 5: RESEARCH FINDINGS

5.1 Questionnaire Findings

Demographics

Working Base of Respondents

Category	Nr of Respondents
Ireland	65
North America	53
United Kingdom	17
Oceania	10
Middle East	5
Asia	4
Europe	2
South America	2
Did not specify	3

Figure 5.1: Demographics of Questionnaire Respondents
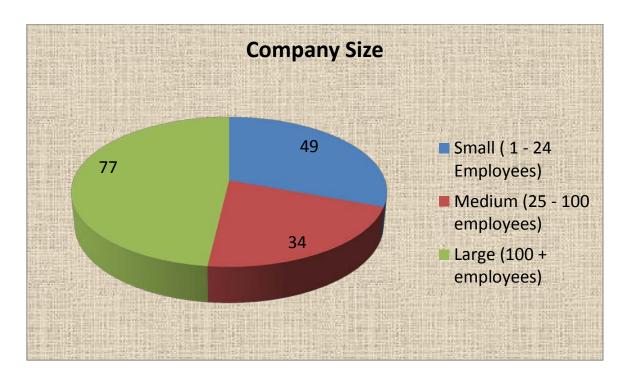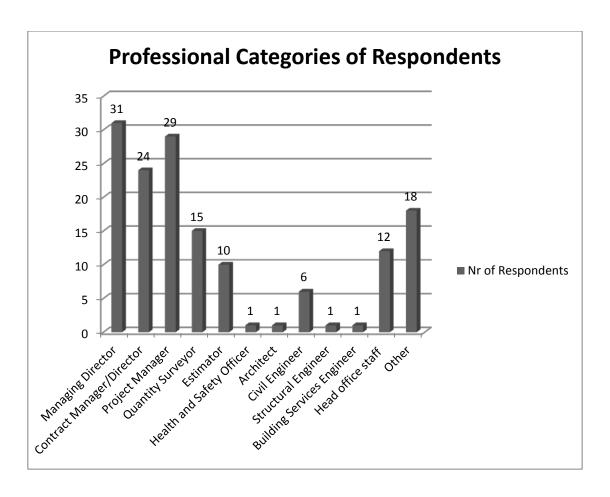
Figure 5.2: Company Size

* 9 UK & 22 US Respondents were not asked about their company size, since they were in the top 100 and 400 companies in the country respectively, assumed large.

Figure 5.3: Professional Categories

The following is a summary of the key positive comments regarding the use of smartphones and tablet computers in the construction industry. All comments made by respondents are included in the appendix.

"The use of these devices will increase; just as night follows day"

"It`s the way of the future, you either embrace it and move with it, or you spend a lot of valuable time consequently trying to catch up to it"

"These devices will revolutionise and streamline the industry"

"Anything that saves time and increases efficiency is a good thing"

"Information for a meeting can be carried on a tablet instead of a multitude of files"

"You can respond to emails immeadiately instead of waiting an hour to get back to the site office"

Positive Comments

"Increased access to information reduces the likelihood of misunderstandings"

"Time could be reduced between the engineer receiving information and conveying it to the construction team"

"These devices will revolutionise and streamline the industry"

"I have only witnessed the use of this technology in the last year, it has saved time"

"Our clients embrace this technology so we do – it aides communication"

"Within the next few years usage will become widespread"

"Costs of data are high but when the benefits are analysed it is worth it, even now"

"Quality assurance requirements may present the necessity to invest in these devices"

The following is a summary of the key sceptical and constructively critical comments regarding the use of smartphones and tablet computers in the construction industry. All comments made by respondents are included in the appendix.

"Shifting to electronic data collection would be immeadiately destabilising and possibly catastrophically risky in the long term"

"There is a shortage of suitable applications available"

"Safety rules will prohibit people from walking around a site with heads buried into phones or tablets"

"This could be an unsafe practice"

"Those in charge (older generation) don`t understand the benefits"

"Work-life balance must be considered; technology makes people available at all hours"

Sceptical and Constructively Critical Comments

"Expectation from the client that tasks are completed immeadiately is disturbing"

"We have some subcontractors who still do not use emails, let alone smartphones and tablets"

"The construction industry always lags behind in technology. Dating back to the acceptance of the fax machine"

"Funding for the adoption of new technology is a problem in construction at the moment"

"Different operating systems is a logistical issue, Apple, Android or Windows Phone; no clear leader has emerged"

"Small screens present challenges. Mistakes can be made"

Current use of smartphones and tablet computers

Out of 161 respondents, 116 (72%) indicated that they used smartphones and tablet computers to carry out tasks as a construction professional.

110 of these respondents gave further explanation regarding what tasks are carried out using this technology.

44 (28%) respondents indicated that they did not use smartphones/tablets in the workplace.

Do you use smartphones or tablet computers as part of your job duties?

No
28%

Yes
72%
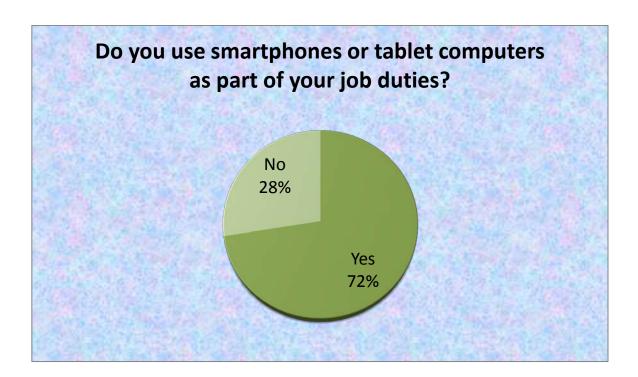
Figure 5.4: Current use of smartphones and tablet computers

To follow on from this question, respondents were asked to give further details about what tasks they carry out using smartphones and tablet computers. A summary of the responses is shown in Table 5.1, on page 40.

Table 5.1: Use of smartphones and tablet computers

Nr	Task	Respondents
1	Work related email, instant messaging and internet browsing	97
2	Basic Tools: Camera, Voice Recorder etc.	26
3	General Administration; completing reports	23
4	Cloud Computing	19
5	Diary, Notepad, Meeting Minutes	15
6	Calendar	14
7	Access to drawings on site	13
8	Planning work; punch list etc.	12
9	Recording of data in the field e.g. Workmanship, snagging, safety, quality control issues etc.	8
10	Maps, Satellite Imagery, Geospatial Imagery	7
11	Networking: Facebook, Twitter and LinkedIn	6
12	Powerpoint presentations	5
13	Marketing	4
14	Using phone`s internet as wifi hotspot for laptops/desktop computers	3
15	Unit conversion, calculation apps etc.	3
16	Site measurements (captured with related photos)	3
17	Conference calling	3
18	Weather forecasting applications	2
19	Building Site Webcams	2
20	Telephone call recording application	1
21	Quick Response Code	1
22	Access to company servers (Intranet)	1
23	Tracking vehicles	1

Use of smartphones and tablet computers by colleagues

When asked if any of their colleagues in the construction industry used smartphones or tablet computers, 82% of 159 respondents answered yes. Of these, 105 chose to provide more details on the tasks carried out by colleagues using this technology. The author analysed these responses to see if any additional tasks were mentioned however the responses were broadly similar to previous answers.
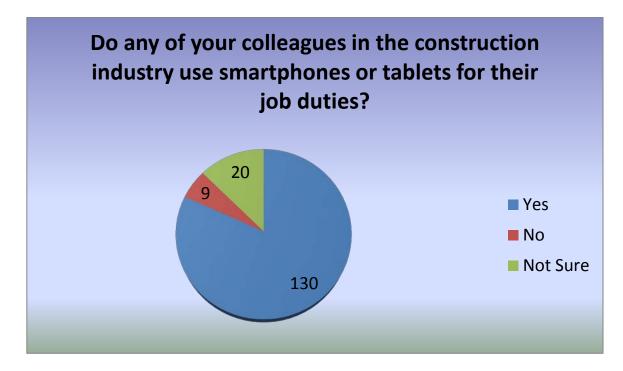
Figure 5.5: Colleagues use of smartphones/tablets

Company plans to adopt more widespread use of smartphones and tablets
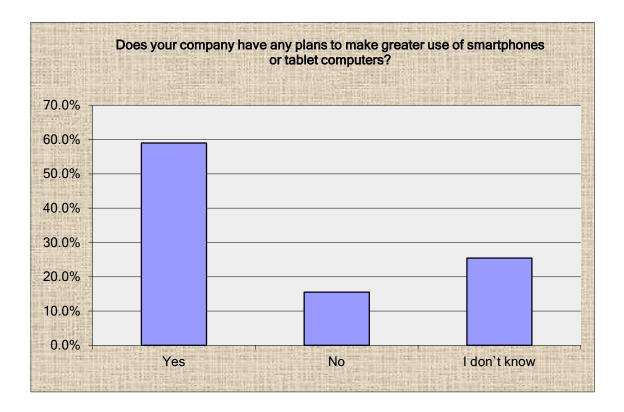
Figure 5.6: Company plans to embrace smartphones/tablets

All respondents indicated their awareness of company plans to make great use of smartphones and tablets. 95 respondents answered yes, 25 no and 41 indicated that they didn`t know. 45 respondents made additional comments in relation to this question which are included in the appendix.

What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

Most responses to this question were similar to the tasks outlined in Table 5.1. Additional responses are included in the appendix.

Construction industry lagging behind other industries in adoption of IT

What is your level of agreement with the following statement? "The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers"

2.3%
12.3%
23.8%
18.5%
43.1%

■ Strongly agree

■ Agree

■ Neither agree nor disagree

■ Disagree

■ Strongly disagree
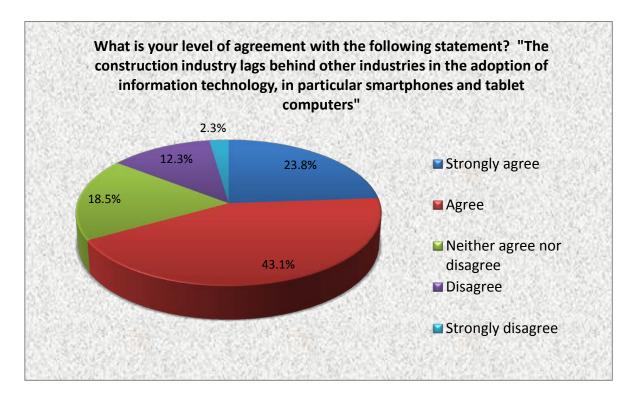
Figure 5.7: Construction industry lags behind other industries

26 respondents chose to provide additional comments after answering this question; responses are included in the appendix.

Administration work in the site office detracts from supervising/monitoring works on site
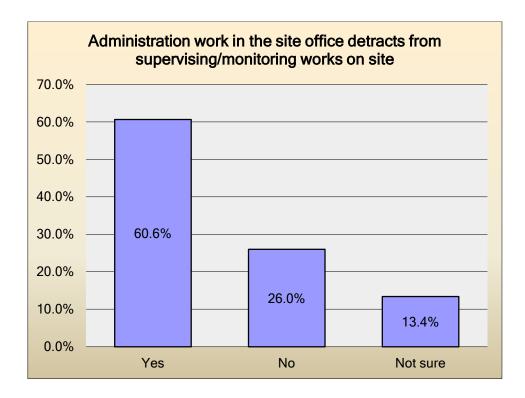
Figure 5.8: Is administrative work a distraction?

60.6% of respondents answered yes, 26% no and 13.4% were not sure. 13 respondents made additional comments which are included in the appendix.

Is it beneficial to access information, capture and communication data in the field?

96.1% answered yes, 2 respondents answered no and 3 were not sure. 12 respondents added additional comments, which are included in the appendix.
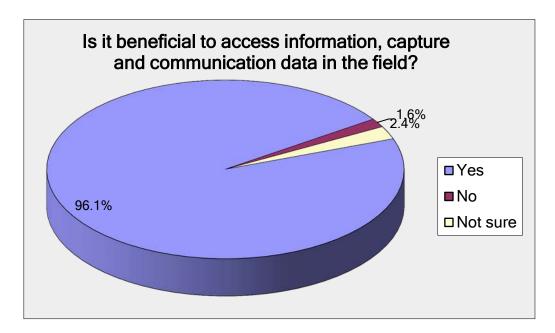
Figure 5.9: Data in the field

Barriers to the adoption of smartphones/tablets in the construction industry

Respondents were given 4 barriers to the adoption of smartphones and tablets and were asked to choose them if they believed that they presented an obstacle to the adoption of this technology. Respondents were also given the choice of indicating that the barriers are not insurmountable. The results are indicated in Figure 5.10.
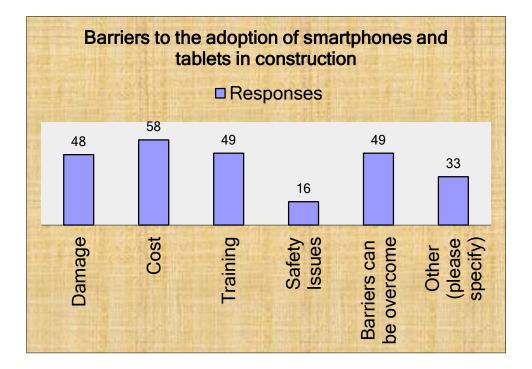
Figure 5.10: Barriers to the adoption of smartphones and tablets

Numerous respondents provided additional obstacles or made additional comments regarding the barriers to the adoption of the technology, which are included in the appendix. Key comments are included in the summary of positive and sceptical/constructively critical comments on pages 37 and 38.

Teaching students about the benefits of smartphones and tablets is key to the construction industry embracing this new technology
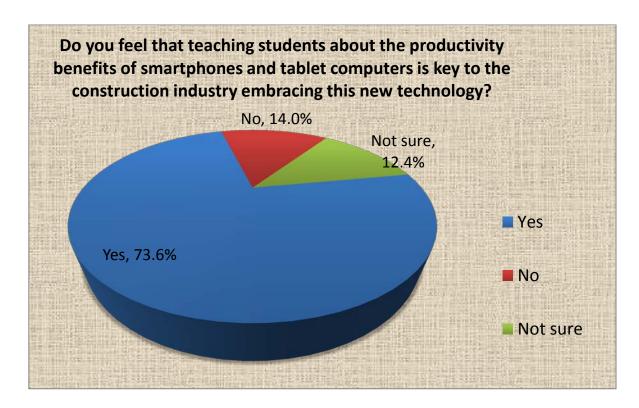
Figure 5.11: Education

Respondents provided additional comments on this point which are included in the appendix.

General comments regarding the use of smartphones and tablet computers in construction

Respondents were given the opportunity at the end of the questionnaire to make any general additional comments, which can be found in the appendix. Key comments are included in the summary of positive and sceptical/constructively critical comments on pages 37 and 38.

Targeted Questionnaire Findings

Targeted questionnaires were sent to Paul Ozinga and Julian Clayton, who featured in an article by Van Hampton (2011) discussed in the literature review.

1. Paul Ozinga

Paul Ozinga is Executive Vice President at Ozinga Brothers, a major ready mix concrete supplier in the Midwest region of the US. Paul emphasised the benefits of smartphones and tablet computers when he said *"Time is money. The ability to gather, populate, inform and stay informed at any time is a huge boost to employee productivity"*

Paul cited plans to further embrace technology: *"as the product evolves so do our ideas and capabilities."* He also mentioned plans build applications from within the company, and revealed plans to reduce printing costs via the use of the devices. Although he agreed the construction industry lags behind other industries in the adoption of smartphones/tablets he argued that the technology will move faster as a new generation enters the industry.

Paul discussed drawbacks to the technology, including information security, the reliability of internet/network coverage, and training workers to use the devices.

2. Julian Clayton

Julian Clayton is Vice President of Technology and Development at Crescent Construction Services. Julian stated that all scheduling, punch lists (snag lists), expense tracking and document distribution is carried out using smartphone or tablet devices. He argued that the benefits are speed, greater accuracy and a reduction in paperwork.

He admitted that the expense of and training in the use of the devices is a drawback at first, but argued that the benefits of cost savings will outweigh the drawbacks.

5.2 Interview Findings

Summary of key findings from the Richard Mulvahy Interview

Richard Mulvahy is the Executive Chairman and Co-Founder of Smartbuilder Software Limited.

Richard, when working as a consultant for a major construction company, saw an opportunity for mobile IT software in the construction industry. He observed that the management of information and people was poor; there was so much going on that people weren`t being managed properly and information wasn`t being acted upon in a timely manner.

They observed that people were beginning to use smartphones for their personal use which would help the industry embrace the technology. The company set about producing software that makes it easier for people to capture information such as progress, safety alerts, snagging, photographs etc. whilst reducing the paperwork at the same time.

Richard made the point that there is a huge amount of paperwork being generated in construction and if anything gets mislaid it can lead to delays, and consequently substantial penalties can be imposed. The companies system captures information and it is stored electronically therefore there is a full audit trail. Richard put forth the view that if there is less paperwork, there is more opportunity for the construction manager to be out on site where the action is happening, where they can make the difference.

The company decided it would be best to store all of the information in the cloud so users can log on from any device, mobile or stationary, to access and edit the information. Richard added that the information is backed up automatically; therefore the reliance on staff in an IT department managing the information is reduced.

Richard argued that it`s a slow process to convince the key decision makers (the older generation) to convert to electronic systems because they are used to the traditional paper systems. He also said that education is vital; the younger generation need to be taught how to relate these devices to the workplace; not just for their personal use.

Richard did not agree that companies abroad are embracing the technology more than in Ireland.

When discussing the possibility of safety or legal issues being an issue regarding the adoption of the technology Richard indicated a few important points:

- It is safer to carry a small device than to be carrying big drawings in one's hand
- Tablets are protected with heavy duty cases and cannot cause any damage
- Devices can be carried in a lanyard to keep hands free
- Devices can work without an internet connection
- Legally, information is safe; when it is synched, it is removed and stored in the cloud
- Information can be deleted remotely if the device is stolen

Richard summarised his views by saying: *"It`s quite clear that capturing/recording information electronically and instant access to information is a huge benefit to an industry that has very low margins(currently), poor work practices, and poor health and safety issues etc."*

Summary of key findings from the Alan Hore Interview

Alan Hore is a director of the Construction IT Alliance.

During the interview discussions Alan talked about how he always believed that there was a better way of doing things; instead of, for example, printing out drawings and measuring by hand.

When asked about the construction industry lagging behind other industries in the adoption of smartphones/tablets, Alan agreed, mentioning the manic nature of the industry; with different sites, clients, architects, engineers and quantity surveyors. Alan pointed out that the industry is starting to catch up in recent years but that the lack of training of construction managers is an issue.

Alan said that tablets are the correct size for working on site, not smartphones. He also is of the belief that iPads etc. are not robust enough.

Alan agreed that administrative tasks are time consuming and can take the construction manager away from the actual construction site. He went on to say that anything that can be done to make the recording of data easier for the manager can help to free up time for the managing of people and co-ordinating of activities.

Alan stressed the value of the site diary and the recording of events, such as the weather, visitors to site, delivery of materials, accidents, progress, quality issues, activities of the workers and plant, standing time etc. He went on to say that these issues are all very important and the recording of them helps with notifications of delays and disruption; especially where a contractor is subject to delay penalties. He also concluded that the idea of a rugged tablet device to streamline the process of recording such information is a no-brainer.

Summary of key findings from the Kevin Rooney Interview

Kevin Rooney is a Project Manager with Walls Construction.

Kevin describes himself as a technophobe. He was requested to obtain a smartphone for work, but he declined. He added that if he had a smartphone his superiors would expect him to respond to an email at the snap of a finger. Kevin spoke about there being a campaign for all staff to be contactable on email with smartphones, but that there was also resistance to this amongst staff for fear for enslavement. The author discussed Volkswagen Group`s new policy of email being shut down half an hour before and half an hour after work. Kevin immeadiately knew about the policy and agreed that it was a good idea in principle.

He stated that all the directors and contract managers in the company used smartphones, and that numerous subcontractors also utilise them. Kevin indicated that he had noticed about half a dozen subcontractors who had been utilising tablet computers.

Kevin answered no when asked if he thought that it would be beneficial to capture and update information whilst out on site. He added that in his opinion it is better to come back to the office and think about things. He explained to the author how he had observed at meetings that certain attendees were carrying out unrelated work on these

devices, and therefore were not giving their full attention to the issues being discussed at the meeting.

Kevin added that the company had tried to ban phones from being used on site due to issues regarding operatives listening to music on them, and not being able to hear activities on site.

Summary of findings from the Brendan O Riordan Interview

Brendan O Riordan is Business Development Manager for Zutec, who provide an online based system for access to project documentation.

The major offering (relevant to this work) that Zutec provides on smartphones and tablets is a programme which allows the completion of snag lists whilst on site. When contacting the author Brendan described how on a particular site in Qatar 150 people are using tablet devices to complete snag list entries, with approximately 2000 snags being carried out per day.

In the interview Brendan argued that carrying out administrative tasks electronically can save an incredible amount of time. He outlined a typical traditional document trail for a sign off sheet as follows:

Document emailed from Client to Contractor → Contractor prints off document and signs/stamps as received → Document is uploaded to the contractor`s system → Project manager downloads, prints, signs, uploads and emails document to client → Client downloads, signs and uploads to another system

Figure 5.12: Traditional sign off sheet procedure

Brendan added that this is happening with a lot of documents because people want to be able to access the documents electronically despite the fact the input of the data was done on paper. He said the Zutec saw the opportunity to shorten this process with what Zutec call "direct data entry".

The author asked Brendan did he feel that project managers spend too much time carrying out administrative tasks. He agreed, painting the picture of a typical project manager carrying out snags in a traditional manner on a construction project:

```
Day(s) spent taking        Next day(s) spent          Snag list saved on
notes on snags on site     deciphering notes,          company system and
                           spiltting into different    emailed to relevant
                           trades and inputting        subcontractors
                           onto word documents
```
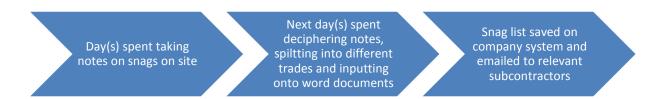
Figure 5.13: Traditional snag list procedure

Brendan argued that by using the tablets to carry out the works the process is streamlined and will take half the time. Brendan affirmed that the cost of the tablet device is quickly recouped with the project manager`s increased productivity.

When asked about barriers to the adoption of smartphones and tablets in construction such as health and safety or training, Brendan said that health and safety wasn`t a problem. However he agreed that training in the use of the devices is an issue. He discussed projects in the Middle East where a lot of the workers are sourced from across the globe, and these workers are generally not used to using such devices.

Brendan argued that the costs in training workers to use the devices are quickly recouped with productivity benefits on site. Expanding on the topic of costs, Brendan asserted that the costs of printing can be dramatically reduced, mentioning that he was aware of contracts where statistics showed that 1.6 billion pages of A4 sheet were printed. Brendan contended that the argument of costs as a barrier to the adoption of the technology can be quickly banished by showing the individual some cost saving figures.

When asked if he was aware of anybody using tablets or smartphones in the construction industry in Ireland Brendan replied "*I`m trying to change that but not yet. People use them but for more basic stuff such as email etc., people do use AutoCAD but it`s a personal thing, not a site wide thing*".

5.3 Seminar Findings

The author attended the seminar "Mobile apps in the built environment" which was held in the Building Centre in London on the 27th March 2012. There were six speakers; five of whom had input relevant to this work, the key points raised by each were as follows:

1. Neil Pawsey, Programme Director, COMIT Projects Ltd

   "Construction Opportunities for Mobile IT"

   Neil started off his presentation by making an interesting point about the adoption of Mobile IT in construction. He quoted the phrase *"The early bird catches the worm but the second mouse gets the cheese"*. This translates as saying that whilst it is important to adopt the technology before others to gain an advantage, it is also important not to rush into things for the sake of it in case things go wrong (in the phrase the first mouse gets caught in the mouse trap and the second mouse gets the cheese).

   Neil spoke about how one of the problems with the adoption of technology has been that construction companies felt technology companies were trying to sell them devices/software without understanding the construction industry whilst using terminology that was not understood.

   He discussed how COMIT was set up to create a wider understanding of the benefits of mobile IT in construction through research and bridging the gap between construction and technology companies.

   Neil mentioned previous studies they had carried out on the use of mobile IT to carry out numerous and varied tasks as shown in Figure 5.14 along with more recent studies, as shown in Figure 5.15.

Pawsey (2012)
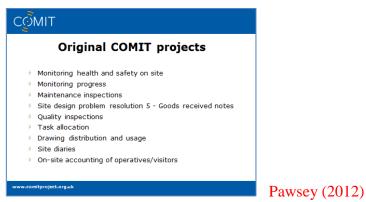
Figure 5.14: COMIT Research; Pawsey (2012)

Pawsey (2012)
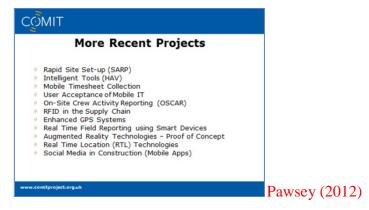
Figure 5.15: Recent COMIT Research

Neil reported that the Costain Group, a Civil Engineering solutions provider, had found that the time spent completing a particular snaglist had been reduced from one and a half weeks to four hours.

2. Chris Ashworth, Managing Director, Competitive Advantage

"Communications Channels for the Construction Industry"

Chris took the opportunity to advertise the construction media index which sells a research report on the traditional and communication channels used in the construction industry. Certain findings are made available for free which focus on how various categories of companies use different platforms to advertise their companies.

55

There were 682 respondents across the different categories of companies in the industry. The findings regarding the usage of applications are particularly relevant to this work; according to this survey the usage of applications is low across the sector (less than 20%), particularly by main contractors (1%).

The survey shows that usage of social media is widespread (over 70% in each sector with the exception of interior designers and quantity surveyors). The usage of social media on smartphones in particular has exploded in recent years due to the convenience of platform. This provides an avenue for construction companies to advertise their business.

3. Bob Leung, Founder, Woobius

"A Sustainable Alternative to Printed Brochures"

Bob advocated the use of applications to promote a construction company; emphasising that they are a mobile form of a company brochure, always available to the sales team, are interactive and can help to win contracts. He displayed interesting statistics (as shown in Figure 5.18) which showed how people are using mobile devices concurrent with other activities. This presents an opportunity for construction companies to increase their chances of winning contracts by advertising their services on the smartphone/tablet platform.

Leung (2012)
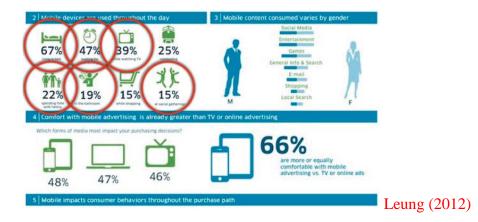
Figure 5.18: Use of smartphones/tablets concurrent with other activities

4. Dr Andrew Hudson Smith, University College London

"Apps to Make Architecture Smart"

Andrew was particularly interested in technology such as QR codes, where a code is placed on a building and the mobile device user can scan the code. This brings up information regarding the building, and is a way of advertising for architecture companies.

As an architect he is also interested in an application called "Mappiness". This application asks the user how happy they are. This is relevant for an architect as it compares the users level of happiness to the local environment i.e. pollution, noise, green spaces etc.

5. Lars Teichmann, Associate, Zaha Hadid Architects

"Why have we got a Mobile App?"

Lars spoke about Zaha`s application for iPhone and iPad which allows the user to browse through its portfolio of architecture and design. He argued that it is a useful tool which helps advertise the companies work across the globe.

CHAPTER 6: DISCUSSION OF RESEARCH FINDINGS

6.1 Current use of smartphones and tablet computers

The author has observed through this research that construction professionals are using smartphones or tablet computers to carry out numerous and various tasks, however the questionnaire shows they are primarily being used for basic tasks such as email and internet browsing.

As outlined in the research findings chapter 72 percent of respondents to the questionnaire (116) indicated that they used smartphones/tablets, 97 of whom indicated they used them for email, messaging or internet browsing. The next most popular choice was basic tools such as camera, voice recorder etc. (26) followed by completing reports (23).

6.2 Comparison with construction industry abroad

In the questionnaire, 46 from 60 respondents (77 percent) from Ireland indicated that they use these devices in work; this shows that the use in Ireland is broadly in line with the use abroad. This finding is reinforced by the interview with Richard Mulvahy who argued that he did not believe that construction companies abroad were embracing smartphones/tablets to a greater extent than in Ireland.

6.3 Key uses and productivity benefits of smartphone/tablet devices

Respondents to the questionnaire indicated over thirty different tasks that they carry out using smartphones/tablets (as shown in Table 5.1 on page 40).This demonstrates how tasks can be completed anywhere without having to rely on the use of the laptop or desktop computer in the site office or head office.

These benefits are also shown in the literature review, where various independent authors such as Ozinga, Parker and Morrison, Stinson, and Hore discussed current and potential productivity benefits of these devices. The literature review also discussed authors such as Smartbuilder Software Ltd and Builder MT, both of whom outline key

productivity benefits of the technology. Due to the fact that the aforementioned authors are selling a service their views must be examined carefully, however their arguments clearly demonstrate the productivity benefits of the technology.

Interviews conducted by the author further highlighted the benefits of the technology. Alan Hore emphasised the importance of recording all aspects of activities on site ranging from the weather to the activities of the workers.

Richard Mulvahy helped to explain the benefits further by discussing the sheer volume of paperwork in construction, which is difficult to manage, and compared this to system of capturing of information electronically which would ensure a full audit trail.

The final interview with Brendan O Riordan further advocated the benefits of this technology. Brendan discussed the typical traditional document trail for a sign off sheet, and the common process when completing a snag list. He compared this to capturing and transmitting the data electronically, and put forth the view that the process becomes streamlined and takes half the time. This view was supported by the findings of the seminar *"Mobile Apps in the Built Environment"* which the author attended. In this seminar it was reported by Neil Pawsey of COMIT that Costain Group, a Civil Engineering solutions provider, had found that the time spent completing a particular snaglist had been reduced from one and a half weeks (traditional methods) to four hours(using tablet device).

Targeted Questionnaires sent to Paul Ozinga and Julian Clayton also support the aforementioned findings, with Paul and Julian discussing the benefits of the technology to their respective companies.

The seminar also highlighted productivity improvements in terms of advertising the companies business. The speakers emphasized how the devices can be used as an electronic brochure, with profesionnals displaying the companys work at short notice in a glamerous fashion which may help to win contracts. This shows how companies can streamline the process of advertising the companies service/product and improve the chances of winning work.

The case study has illustrated how various tasks can be completed using smartphones/tablets and reflected upon how it may inrease productivity on site.

6.4 Use of smartphone/tablet devices in other industries

The literature review highlighted impressive statistics regarding the use of smartphones/tablets in industries other than construction. Ottawa hospital utilises 3000 iPads for its 12,000 employees; or one device for every four employees. American Airlines has been approved to use iPads in lieu of paper flight manuals. Gannett, which is the largest newspaper publisher measured by circulation in the United States, has purchased thousands of smartphones and tablet computers for its journalists. The aforementioned facts represent a huge endorsement of the technology across three very different industries.

The questionnaire asked respondents did they agree that the construction industry lagged behind other industries in the adoption of smartphones and tablet computers. Sixty seven per cent of respondents agreed. Respondents also commented that *"safety issues present problems not prevalent in other industries", "Outdoor use can be restrictive for this technology"* and *"the gaps between industries baffles me"*. These comments highlight reasons why the technology hasn`t taken off as of yet. Similar comments can be found in the research findings chapter and the appendices.

Furthermore during the interviews conducted by the author, Richard Mulvahy, Alan Hore and Kevin Rooney all agreed that the construction industry lags behind other industries in the adoption of this technology

6.5 Questionnaire Comments

It is evident from the questionnaire that the majority of construction professionals see the benefits of the technology, with many respondents commenting that their company is examining the possibility of embracing smartphones and tablet computers.

Conversely many respondents indicated barriers to the adoption of the technology such as the cost of, damage to, training in the use of, and the awareness of the benefits of the technology. These views were echoed in the interview the author carried out with Alan Hore, who believes that tablets are not robust enough, and argued that the

lack of training of construction managers with technology is an issue. However the argument that the devices are not robust was dismissed in the interviews with Brendan O Riordan and Richard Mulvahy, who argued that the devices can be protected by purchasing a robust cover.

The negative effect that smartphones/tablets could have on employee`s work/life balance was also a popular comment by respondents to the questionnaire. This view is reinforced by comments made by Kevin Rooney in an interview carried out by the author. Kevin commented that *"if I had a smartphone my superiors would expect me to respond to an email at the snap of a finger"*. Kevin added that there was a resistance amongst staff against this *"for fear of enslavement"*. It is clear, therefore, that although respondents see the benefits, there is much scepticism in industry regarding this technology.

A summary from the questionnaire of the constructively critical, sceptical, and positive comments regarding the adoption of smartphones/tablets in construction is shown on page 39 and 40.

CHAPTER SEVEN: CONCLUSION

7.1 Conclusion

This research has shown that the adoption of smartphones and tablet computers in the construction industry is in its early stages of development. There are a number of companies around the world who provide specialised construction software for these devices, and when the benefits are fully appreciated across the industry the number of these companies may increase.

The questionnaire has highlighted the variety and number of different tasks that are currently being carried out with these devices; however, the majority of the respondents indicated the devices were being utilised for basic tasks such as email, which demonstrates that there is room for further embracement of this technology.

A number of positive comments were made regarding the technology, and a number of sceptical comments were also made; this shows that the industry is somewhat divided on the issue. However the awareness of the potential of this technology will inevitably lead to greater adoption of the technology with time.

Interviews with industry professionals and the attendance at COMIT`s seminar has yielded information about the staggering time savings that are possible when completing snag lists on large projects using tablet devices. If other administrative tasks were completed using these devices and yielded a fraction of the aforementioned time savings productivity would increase across the spectrum. The time savings combined with the savings from printing costs may result in significant cost savings for construction companies.

The establishment of industry research initiatives such as COMIT and FIATECH demonstrates how industry experts are clued in to the potential of this technology. Furthermore many questionnaire respondents expressed their interest in this topic and requested a copy of the research findings. Ryan Briggs from Woobius (who are a mobile app developer for the building industry) expressed interest in collaborating in any future research the author may be involved in. The aforementioned facts demonstrate the keen interest from industry professionals in this technology.

The capabilities of smartphones and tablet computers have increased dramatically in recent years; over time it is inevitable that the construction industry will further utilise the devices to increase productivity.

7.2 Further Research

The author recommends that further research is undertaken regarding the productivity benefits of using smartphones and tablet computers in the construction industry. The establishment of research groups such as COMIT and FIATECH which have researched the use of mobile devices highlight not only the interest in the technology, but also the complexities of the issue.

To fully understand the benefits, a detailed analysis of the time and cost involved in carrying out tasks in a traditional manner should be completed. This should then be compared to carrying out the same tasks using the smartphone or tablet devices.

The author would have liked to have done the aforementioned analysis as part of this research; however this was not feasible given the time constraints, cost of purchasing devices and obtaining suitable software. Research would have to be carried out over the length of a contract to come to a conclusion regarding the full extent of productivity benefits / cost savings.

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APPENDICES

APPENDIX A:

INTERVIEW TRANSCRIPTS

APPENDIX A.1:

RICHARD MULVAHY INTERVIEW TRANSCRIPT

Richard Mulvahy Interview

Questions asked:

1. How did you develop an interest in smartphones and tablet computers in the construction industry?

2. Can smartphones and tablet computers really make a difference in the construction industry?

3. Do you believe that the construction industry lags behind other industries in the adoption of information technology?

4. If so, do you think this is due, in part, to the highly fragmented nature of the industry?

5. Do you think that construction industries abroad are embracing smartphones and tablets more than in Ireland?

6. Do you think that some construction managers may neglect to impose their presence on site due to administrative tasks being carried out on computers in the site office?

7. In your opinion, what are the barriers to the adoption of smartphones/tablets in the industry?

   E.G. Safety, Legal Issues, Workers set in their ways

8. The smartbuilder1 software is a web based system, what are the advantages/disadvantages of this over an application

9. Do you have any other comments to make regarding smartphones/tablets in the construction industry?

Richard Mulvahy Interview Transcript

R = Richard
I = Interviewer [Andrew Doyle]

R   So where it started off, technology started off, it was with AutoCAD and the architects designing software and the quantity surveyors used to use spread sheets and things like that for calculating costs in general.

I   I used to work as a QS, well kind of trainee QS. For Tricastle, concrete sub-contractor.

R   Okay.

I   So I did a lot of work in the office on computers but if we had tablets etc. we could probably have marked up stuff on site.

R   Say on the quantity surveyor side what software where you using there?

I   Mainly Excel just to do productivity reports and applications for payments and so on and they would use AutoCAD and PDF and Word that's about it really.

R   Right so are you familiar with the Master Construction programmes, software's that are out there?

I   Like Asta Power Project and that?

R   Yeah Microsoft Project as well.

I   Yeah I was using Asta the last semester for a project.

R   Okay.

I   Basically a construction programme.

R   Right so that's the backend, so that's what the office would use that but it wouldn't transfer out onto the site though?

I   No.

R   Well I suppose I'll give you a little bit of background where we came from, I was doing consultancy for a Donegal company, a Construction Company. And they were on about twenty sites; my job as Chairman was to ensure that the company was being run properly.

I noticed when going out on site that there was a huge amount of wastage of materials and equipment been left around that had been hired and hadn't been returned yet.

Men were not turning up to do the full day's work and I realised why the margins were so small in the construction sector: because the actual management of information was not good, the management of people; because there was so much going on the people weren't being managed properly and the information wasn't been reacted on quickly enough.

So my colleague Peter (Daly) who I had worked with on other projects, I asked him to do some research with me on it and we looked into the whole sector of what software, if any software was been used on sites to capture information to transfer back to business information modelling or the Master Construction Programmes and we discovered there wasn't really any. There was one company in America, one company in Australia and they were using these very heavily.

I   PDA's.

R   PDA's yeah, which was a big problem because first of all they were very costly to use and they weren't user friendly, but nobody was using tablets or smartphones.

And we figured that more and more people were using smartphones anyway, they were used to touch screen phones, they were beginning to get used to it and the construction sector had embraced standard mobile phones very quickly.

So we decided we would produce software that would use that type of technology and by making it easier for people to capture information and reducing the cost of actually using the technology on site that more people would adapt it, so that's what our focus has been, to develop software that

should be able to download key information from your master construction programme like the tracking of progress, safety alerts, all of those type of things. When you are doing snagging, all of that type; to capture that and send that back electronically, rather than paper, rather than have to carry out drawings on site and having separate photographs that you could link it all together and hold on to an audit trail of all of that.

I   And other people could access the system at the same time…

R   So we had to look at what was the best way of producing the software. What we've produced, it's all stored in the cloud and people can log on their PC's and they can look at different sites where there are issues, where there are hold ups and they can respond quicker to that. We've been developing the software for two years, it's live now in a number of sites but like any industry that hasn't embraced technology it's slow to convince people to do so.

I   Difficult to get going I suppose.

R   Yeah it's a slow process in getting the decision maker to see the benefits, they are used to paper systems so now how do you convince them to convert over to electronic systems?

I   I remember there been folders and folders and folders of information on a job…

R   There's huge paper generated and the big problem in paper being generated is paper can get mislaid. You lose some pages or something like that which can cause your project to be delayed. There's interesting statistics in the UK on commercial projects that the average commercial project runs between 30 and 120 days late, so that's a significant cost to the construction company.

I   Definitely especially if there's delay penalties.

R   Well if there are penalties and because they are using manual systems if there are delays, unless that information is captured electronically which our system does then there's legal disputes about the cause of the delay. Whereas our system captures that all electronically so there's a full audit trail.

So there are lots of positive reasons to convert to this technology, it's really getting the construction industry to look at that. Say in Bolton Street, what they are teaching you there, how much focus is on technology out on site?

I   On IT you mean?

R   Yeah.

I   Yeah very little.

R   Yeah so if that's a college where people are graduating from, you know what's the mind set of these people coming out then, they don't see the benefits because they are not taught about it in college.

I   We've been taught how to use AutoCAD and Asta Power Project that's it really.

R   So any questions on that at all?

I   I drafted up some questions earlier on, that's a copy of it, I suppose we have answered a few of them already.

R   Okay well sure we can go through them anyway.

I   You told me how you got involved with the technology so that's fine, so just make the point that buildings have been built for thousands of years and basically what I'm asking is can smartphones and tablets really make a difference?

R   The key is instant information and therefore if you have instant information you can react instantly.

I   Yeah less man hours and labour and costs involved then.

R   Well the huge benefit to our project managers is they go out on site with paper and they mark up all their sheets and they go back and they have to write their report from that and they have to then email different people for safety alerts; if sections aren't completed on time they have to notify different people. If a sub-contractor is looking for payment because he says the job is done; whereas they

are still snagging and it's not done then all of that has to be sent to a number of different people.

Using the tab or software it can be done instantly so that information is sent to a group of people, we sent it to accounts, to the surveyor; it can be sent to the health and safety officer, it can be sent to a load of different people to notify them…its instant information.

I   Yeah so you are streamlining the whole process?

R   Yeah.

I   Do you believe the industry lags behind other industries?

R   Absolutely, they have it's a very hierarchical industry trying to get the, to get to the key decision makers is very difficult.

And the key decision makers tend to be the older generations and therefore don't see the benefits in investing in the technology.

I   Yeah as time goes by I suppose the younger generation might be more open to it.

R   Well again go back to the point they are not teaching it in college, there is still going to be.

I   Difficulty.

R   While the younger generation are using technology for other things, are they going to be able to relate that to their work and see the benefits to their work? It's all about education, so it's going to be a slow process I believe.

I   I saw an article about Ottawa Hospital, they have twelve thousand employees, they've bought three thousand I Pad's for all their staff …so it just shows that's a major endorsement of the technology.

R   Well not necessarily I Pad's because it's a very closed system.

I   Are you operating on android is it?

R   We are operating android yeah, I Pad is Apple which is a very closed system really and can't do anything like the functionality that android can.

So when we looked at the system we decided we had to go with an open system.

I   How do you mean closed system?

R   Well for example just a simple little thing if you find a health and safety issue and then you take a photograph and attach a voice message to it and then you want to send that to a safety officer and to send it to three or four different people, on android you can just do a call on the programme to pull up your contact list.

With an Apple you can't do that, you can't pull from your contact list so it's a closed system in that way.

I   Okay so there's more potential in android.

R   Yeah there's much more potential and also Apple charge 30 per cent revenue on any software that's sold through them using their system so it's an issue.

I   Do you think the industry lags behind other industries because it's highly fragmented with different sub-contractors and loads of different parties to the contract?

R   Well at the end of the day it should be driven by the contractor and our software we produce gives access to sub-contractors to close off what they think is completed work where ultimately it's the contractor who decides whether it's closed off or not so he can open it up again. So it does link to the sub-contractors and we imagine it will be driven by contractors not sub-contractors.

I   Number five: do you think industries abroad, construction industries are embracing the technology more than in Ireland? I guess just by the pure size of the industry abroad?

R   Well we have a number of customers who are equally between Ireland and England. So I don't think it that's true really, you know, a builder is a builder.

       They're the same in virtually every country so I don't see any difference between Ireland and England in that.

I   Number six I was just making the point that a construction manager's main job is to be out on site supervising works, because they are doing IT and Admin work in the site office they might neglect their duties on site.

R   Well again that comes back to the efficiency in paper versus electronic; if they've a lot of paperwork to do, they are going to be spending more time in the site office rather than out on the site and that's the whole idea of using the technology is that they will be where the action is happening, where they can make the difference.

I   And some managers, maybe more on call out on the site that will mean they will neglect the IT tasks in the office, if they prefer to spend their time out on site.

R   Well they may prefer to be out on site but at the end of the day if they spend a lot time out on site they are going to have to put the hours in at home or somewhere, so they are just making their job longer.

I   Number seven, do you think there are many barriers to the adoption of smartphones and tablet computers in the industry such as safety issues, legal issues?

R   Well when you say safety issues in what way, what do you mean by that?

I   Like issues around carrying I Pad's around on site, there's a lot of safety applications and rules and regulations and do I Pad's and tablet computers have to be brought into those regulations?

R   Well our software works in aeroplane mode so it's you are not using it as a phone so you are not being distracted.

       When you are entering the information you enter all the information, then you sync it in batches whenever you want so it means that you don't have to be using it as a phone. It's just another way of capturing so information so it's no less

safe than standing there with drawings, it's safer because you are not holding big drawings in your hand; you are using a small unit.

The actual tablets are protected with heavy duty cases so they can't do any damage if you drop them. Regarding other safety issues it doesn't compromise you carrying a lot around; your hands are free because you can have it in a lanyard so from a safety point of view it's safer to be carrying a tablet around.

From a legal issue point of view our software works in such a way that when you are going out on site you download all the drawings that you need for that site visit, so all the information is held on the tablet, the drawings and any of the documentation you need and once you sync it, it removes it from the tablet so if the tablet is stolen there's no information on it.

If it hasn't been synchronised and the tablet is stolen the Samsung, (we recommend the Samsung Galaxy tab), that can be wiped remotely so the information can be wiped if somebody steels it and also the tablet itself can be locked down so that it could only be used for our software. From a legal point of view there's a lot of protection for the information there in that. Then obviously the adaption of the technology; yes people are always set in their ways and the older you are the more set you are in your ways… so there is a whole education process there of educating people about the benefits.

Once we see clearly the benefits of doing something differently, if it makes a difference to our own quality of lives we adapt it. herefore the critical thing is how the software is designed so it's easy to use for people who aren't IT literate.

I   Okay your system is web based so I'm just going to ask you about the advantages or disadvantages of this compared to having an application that you would buy from a store?

R   When you say buy from a store?

I   Android market.

R   There are lots of systems that you can buy from a store that are web based, they are things you have to understand, either you have an enterprise wide system to

use where you've got your own computer where all the information is stored on it or you have a web based, a SAS system which all the software stored in the cloud and the advantage of that is that you don't have to worry about maintaining your own information, it's backed up automatically so it's safe for you, it's less costly because you don't have to have staff working in the IT to manage your information for you.

So there are significant advantages to having a SAS based or web based system.

I   Okay do you think applications have the potential to be more user friendly than SAS based systems?

R   Well software as a service now is that's just storing information in a cloud.

I   Yeah that's the only difference.

R   Against what, against a system in your office?

I   Well I was reading your article "Smartphones on Site" and I think the point was made in it that disadvantages are it could drain the battery if the internet is always required.

R   Well if the internet… yeah sorry if internet is required, so you mean connectivity when you are on connected the full time.

         You don't need to be connected the whole time, the whole idea is you are not going to get a signal the full time.

I   Yeah so it's only when you go back, when you are finished on site.

R   When you are finished you just synchronise it all and just send it in one go. Getting coverage is still a problem in a lot of places, consistent coverage, the advantage of using our software is that you can be working a half a mile underground, recording your information and when you come up you just sync and send.

I   That's good, that's all the questions I have, do you have any other comments to make?

R   Well just my comments would be that it's something that colleges need to look at as part of the education system colleges need to be looking at that aspect to it themselves; to develop the education around what technology is there. If you guys are in your final year and you've done nothing really on technology out on site, and the college haven't touched that then it doesn't speak highly of the education that you are getting.

And therefore in a way it weakens your position going out into the marketplace, they should be coming along and saying there's this technology and that technology available and teaching the benefits of that. I mean it's quite clear that capturing information, recording information electronically, and instant information is a huge benefit to an industry that has very low margins now, has very poor work practices in general, has very poor health and safety issues in general, that technology can make a huge difference to it.

But if it doesn't start off in the colleges where people are being educated and talking about that well then there's a fundamental problem with the education system.

I   Yeah definitely.

R   I'd like it to be repeated to your tutors. My words but you can tell them.

I   I'm meeting Alan Hore he's a lecturer in DIT tomorrow.

R   Oh right yeah okay.

I   I don't know if you know him?

R   Yeah.

I   I think he's involved with COMIT?

R   Our Peter knows him.

I   Oh right so I'll tell him that but I won't say you said that.

R No I mean you can say that you've been talking to us about the technology and stuff like that but it's certainly an issue that and he will be very positive towards technology.

I I think he has a keen interest alright.

R He has, so it would be worth mentioning from your point of view as an educational thing that they start looking at that, because I mean you are going to be the leaders of industry in the next twenty, thirty years.

And you have to be of the mind set to say you know we can do it better.

I Right that's it on the formal questions, I was just going to ask you as well do you have any contacts in COMIT or in companies that are using your software?

R Well Peter is a member, we are a member of COMIT and we have done presentations at COMIT, we have done a presentation, two presentations I think already.

I I'm just trying to get a few more people lined up to get their views or get questionnaires, just expand my research you know.

R Okay there's nobody else doing that technology in Ireland; I think we are the only technology company doing.

I Or even companies that are using your software, even to just?

R We have two companies here that are using the technology; they are both working on secret projects.

I Right.

R For international companies I can't mention the names.

I Okay.

R And the problem with these two international companies that they are working for would be very IT based. Because the technology is capturing it electronically

they are very careful about it, they wouldn't talk about it so. They are paranoid the companies who are they are doing construction work for so.

We had to disable the camera in fact on the units so they can't take photographs because they are so paranoid about their IP.

I   Yeah no that's fair enough, basically I'm trying to get talking to more people involved so I've been looking at COMIT, I can contact people from there.

R   What you should do is you should talk to a company called Bentley. And they do business modelling systems, they do software to show 3 dimensional buildings and things like that. I think they are based here in Dun Laoghaire.

And they are more back office again so we were talking to them and I'm just trying to think, I mean AutoCAD have you talked to them?

I   No I haven't, they have an office here in Dublin do they?

R   Yeah I think they have an office in Dublin. And it's worth talking to them, who else would you talk to? Does your research extend to the UK or?

I   I'm looking abroad as well.

R   You have you Peter's email don't you?

I   I do.

R   He will give you the name of the equivalent of COMIT in the UK that we are members of as well and they....

I   It's not FIATECH is it?

R   No they are more into technology, no they've been going a lot longer but they might be able to give you some advice as well so if you email Peter on that.

I   So it's the equivalent of COMIT?

R   Yeah in the UK.

I   Another thing I was going to say, can you recommend any literature, I've got a lot of literature lined up but just if you can think off the top of your head?

R   Literature as in?

I   Websites, journals, books.

R   It's all about trawling the internet.

All about that, I mean when we were doing our research that's how we did it, we just trawled the internet, I'd do that so, I mean if you look at construction magazines there are a number in the UK, construction magazines and but you will see very little technology advertised in them.

I   Because it's kind of a new field so it's hard.

R   It's a new field and so people aren't particularly aware of it. We have advertised in a number of the journals in the UK and people aren't responding to that, it's a matter of finding early adapters. Like you know we were over in the UK before Christmas and we just met an Irish guy in fact who had been moved over to work for a company and we showed him the technology and the next day we had an order for it which is highly unusual, normally there's a long process but he was obviously in a position of influence.

We could be advertising in a magazine for a couple of months and we would get very few enquiries so it's about trying to find somebody who is very interested in the technology and understands the benefits of technology but it's worth trawling the magazines to see how little there is in it.

I   I can make a point about that as well yeah, there is a not a lot out there, that's fine.

R   Okay you will give us a copy of your thesis will you?

I   I will.

R   That will be good; it will be interesting to see that.

I   Yeah, it should be, I have to submit it the 17th April.

R   Right.

I   Towards the end of April I'll send you a copy.

R   That will be great so I hope that is some use to you.

I   Yeah thanks.

R   I'll give you my card so you can contact me.

End of interview

APPENDIX A.2:

ALAN HORE INTERVIEW TRANSCRIPT

Alan Hore Interview

Questions asked

1. Please tell me how did you develop an interest in IT in the construction industry?

2. Do you believe that the construction industry lags behind other industries in the adoption of information technology?

3. If so, do you think this is due, in part, to the highly fragmented nature of the industry?

4. As Executive Director of CITA, do you have any knowledge of construction companies using smartphones or tablet computers to carry out tasks?

5. Do you think that construction industries abroad are embracing smartphones and tablets more than in Ireland?

6. Do you think that some construction managers may neglect to impose their presence on site due to administrative tasks being carried out on computers in the site office?

   Conversely do you believe that some managers may be more comfortable out on site, and may neglect their administrative duties in the site office?

7. In your opinion, what are the barriers to the adoption of smartphones/tablets in the industry?

   E.G. Safety, Legal Issues, Workers set in their ways

8. Do you have any other comments to make regarding smartphones/tablets in the construction industry?

Alan Hore Interview Transcript

A = Alan
I = Interviewer [Andrew Doyle]

I   Can I ask basically just a bit of background, so how did you...?

A   How did I develop an interest in IT?

I   Yeah.

A   Well I suppose during the 90s... particularly the early 90s there was what we call the dot com boom and there was two particular individuals on the floor above me here that developed a very successful piece of software called Build Online and Build Online became a very successful project collaboration software.

And, you know, the company sort of expanded across Europe and I started to get interest in the area because I started to engage with the two lecturers upstairs and also I started to visit the UK, conferences in the UK.

Particularly Construct IT in Salford, they have a centre there, a centre run now by Jason Underwood, he's still there, and that was a centre of excellence for use of IT in construction.

I   Jason Underwood is it?

A   Underwood yeah. You can easily get him online.

So myself and Ken Thomas in Waterford IT had a similar interest and we talked about the possibility of developing something similar here in Ireland so we set about organising a conference and it was in 1995 and I organised ... sorry 1998 and I organised the first CITA conference called 'Harnessing Potential of IT in Construction' that was downstairs in room 281 and it was sponsored by my two friends upstairs, Build Online, and really it mushroomed from there. My interest was really always I suppose first and foremost as a QS I always believed that we could do things better …particularly I always thought it was strange that we were printing

drawings and then we were sort of hand measuring things and I always felt there was a better way of doing it so.

I   Do you believe the industry lags behind other industries?

A   It does significantly but the main reason it does is that the kind of manic nature of construction is that you have different sites, different clients, different architects, different engineers and QS's.

It's very hard to kind of simulate an industrial type or a manufacturing type scenario when you have...

I   So fragmented....

A   ...yeah when it's so fragmented. So yes it does lag behind other industries, but I think you'll find though in the last couple of years that it's starting to catch up and actually there's some very sophisticated technologies now being used on sites and by design teams.

It`s also about the poor ... the lack of training, you know, we're not training our construction managers...

I   Even the students.

A   ... and our surveyors to deal in these technologies...so really we're culpable to an extent, you know.

I   That`s what Peter said on Monday. He said education of the students, it all starts there.

A   Yes. It does, it does.

I   And they're not getting...

A   Absolutely. Absolutely Andrew.

I   So number 4, are you aware of any companies that are using in particular smartphones and tablets as in iPads?

A   Well I know my own experience of using these when I did my own PhD I worked on using a handheld device with John Sisk......and it was used mainly to capture deliveries of materials, concrete materials and such like. Specifically no not in the UK, not in Ireland. I believe that Laing O'Rourke in the UK use handheld devices on site now for general sort of site management.

And that is then synced back to, you know, a central hub where the site diary, labour returns, any photographs, visitors on site, any instructions – it's all recorded seamlessly on the tablet. The thing about handheld devices is that they ... smartphones, they're too small. It's the tablet is the correct size.

And unfortunately the iPad, a fantastic piece of equipment – I have one myself, you know, they're not robust enough and ... but I suppose if I was to answer your question directly no I'm not aware of any particular...

I   Okay, that's fair enough.

A   ... and I wouldn't mind finding out.

I   Number 6, do you think that some construction managers may neglect to impose their presence on site due to carrying out IT tasks in the office? They go out on site to supervise the works, and then they have to come back in and, upload photos that they've taken on site and that sort of thing...

A   Yes, yeah.

I   ... and they're marking up drawings on site and then they're coming back and using the.

A   Yes I think it's one of the skills of a good site manager or a project manager is kind of the hands-on approach on site, everything that you can do to make his job or her job easier by way of, you know, recording data on site has to be a good idea, it then frees that person up to manage people and to coordinate things, yeah.

I   And yeah just going on from that I made the point that some managers may be more comfortable out on site...... and that they might neglect their work in the office or...

A   Yeah but they could actually combine both of them together.

So, you know, they're going around talking to the guys on site, they're observing for themselves the problems, they're recording the problems, that can all be done at the same time, you know.

I   Some companies I think don't like their employees having their phones or whatever on site because they could be listening to music; there's health and safety issues.

I've heard of jobs where they even put in jammers to stop people using their phone.

A   Oh very good.

I   Communication jammers. So there's issues there as well.

A   But you know they don't have to be web linked, once they're back in their office they plug it in and it syncs ...

I   Upload then.

A   ... it uploads the information. I mean I suppose I'm a Contractors QS, I was for 15 years in the UK. I always thought that the most important relationship to have on a construction site is the working relationship between the project QS and the project manager, particularly from the point of views of ... I mean you don't know how invaluable the site diary is; what weather did you have that day, what visitors were on site, what materials were delivered, were there any accidents on the site, what was the general state of progress...

I   And quality issues.

A   ... quality issues, what the men were doing, what the plant was doing, you know, so you could see if there was downtime for plant disruption of labour, what position were in you with regards to the scaffolding. So many issues, really rich information...

I   That can be used. In disputes and stuff.

A   Well yeah, unfortunately yes, but also to protect the interests of the contractor. Under the government forms of contract now the contractor can be time barred if he doesn't submit notifications for delay and disruption. It's not an excuse that he didn't get out on site that day. This idea of having a robust ruggedized tough pad...

... where you've got like simple buttons for recording what's being done and then syncing it back to your office, I know that these guys go back to their office and write their reports...... this can be done for them.

I mean it's a no-brainer.

I do know there are a few successful companies; there are a few successful companies out there now that are getting into this space. Are we onto 7 now?

I   Yeah. I've just listed a few barriers to the adoption of devices on site.

A   I think the devices can be safely sort of held and harnessed to the body, they don't have to be carried by hand like you don't have to be distracted by them.

Voice recognition can be used as well. Noise on site, there are issues around noise on site and everything else. But once you're in a safe location you can use them I think safely, you know. Legally, I don't see any more issues with legal.

I   Well I read an article about phones or tablet computers in particular if the employee owned the device or...

A   Oh yeah.

I   ... let's say the employee left the company......and took the phone with them, if it belonged to the company. Or they're able to steal data from the company, there could be issues there. But I think you can have them deleted, delete data remotely.

A   Have you heard of COMIT?

I   I have.

A   You have, good man, well then you're on it then.

End of Interview

APPENDIX A.3:

BRENDAN O RIORDAN INTERVIEW TRANSCRIPT

Brendan O Riordan Interview

Interview Details / Contextualization:

Date/Time: 16/03/2012, 2pm
Interviewee: Brendan O Riordan
Gender: Male
Position: Business Development Manager, Zutec Ltd
Position Held: June 2011 - Present

Questions asked:

1. How did you get involved in Zutec and how did Zutec see an opportunity for Mobile IT in construction?

2. Do you believe construction companies abroad are embracing tablets/smartphones more than in Ireland?

3. Do you believe the construction industry lags behind other industries in the adoption of tablets/smartphones?

4. What are the barriers to the more widespread adoption of this technology in your opinion?

5. Do you believe construction professionals time spent completing administrative tasks in the site office detracts from supervising/managing on site?

6. Can you show me examples of the use of tablets for snagging? This may help me in the case study chapter of my research.

7. Are you aware of any other professionals in the construction industry that are using smartphones/tablets that may be willing to discuss their use of it with me?

Brendan O Riordan Interview Transcript

B = Brendan
I = Interviewer [Andrew Doyle]

I   How did you get involved in Zutec and how did they see an opportunity for this technology...?

B   Well personally I got involved, I applied for a job and that was it, you know, not like the Director or anything like that.

Zutec starting doing operations on maintenance manuals in the late 90s, electronically, first on CD and then via internet and web servers and recently enough within the last 18 months they've seen the advantages of mainly snagging through tablets. But also being able to access project files etc., via tablets.

But mainly what our focus is is inputting information via the tablets rather than output, so we put in snag lists, commissioning reports etc., via the tablet and then it's synced to a web server and it can be accessed by anyone whereas a lot of other people are doing it the other way, they have the information and they can access it via tablet.

Which we do as well because it's a simple web server we don't need to worry about that, you just log onto our website, sign in, and you'll get into the information.

But the really...the hard stuff if you like, the interesting stuff that's making a difference, is inputting information and I'll go through that with you again but that's where they saw the opportunity, there's sites out there where they hold files on something like Aconex or BIW, say a signoff sheet.

And it would be emailed to the contractor, they'll print it off, stamp it received, scan it, upload it to their system and then the project manager will download that file, sign it, upload it to the system again.

And it's a document that was downloaded, printed off, signed off and uploaded to maybe another system.

So for the same piece of paper just a stamp and whatever, it's been downloaded and printed three times and scanned three times.

And that's the way things were going with paper because people still wanted to be able to get to all their snagging, commissioning, signoff details via a web server or some kind of server but the input was still via paper...... so that was where the gap was.

And then we, you know, as best as we can tried to...shorten the process. We call it direct data entry. So you're entering it directly via the tablet or whatever it is and I'll show you now when we go through it.

I   And it's synced wirelessly to a cloud storage is it?

B   Yeah just once you're on, have a WIFI you just ... well I'll show you all that once we go through it, I'll show you the actual process.

I   Do you think companies abroad are embracing things more than in Ireland?

B   I do in a lot of ways in ... yes they are to be honest, you know, the specification going into contractors now have been the same specifications for 20 or 30 years. It has changed sometimes to on CD rather than three copies or whatever it is.

And when that's digital that leads into the snagging commissioning being digital, it's a question of who decides. You know, the contractors over here feel that unless something is speced they're not doing it whereas when you go ... we do a lot of work with different international companies and the Middle Eastern, you know, they're not necessarily Middle Eastern companies, they're Japanese, Australian, American.

The Australians are actually quite far ahead, they're kind of one of the main ones. They've got some great systems. And then the Japanese, oh they love it, the Middle Eastern guys, they like it as well. Whether they use it right all the time that's one thing but they do like it so they're definitely ahead of Ireland and again it's Ireland. At the moment from a contractor's point of view, you know, you tender for a job and the tendering process now the pricing is so tight.....the

competition is so tight to get any job there's no extras going in, there's nothing like this going in, if it's speced they'll do it but otherwise they won't.

So it's coming from project management, architects and consulting engineers, they're the ones that need to be enforcing contractors use it. Contractors will do it, they always will.

So I suppose that's for Ireland.

I   I don't know if you've any angles in other industries, have you seen it being used?

B   We do yeah, you know, you look at it if a DHL or UPS guy delivers a...

I   Yeah he gets you to sign a

B   ... to sign on a thing, that's ... for something that's worth $4 or $5, you know what I mean?

I   Yeah.

B   Whereas if you're handing over a €50 million building there might not be any of that. So absolutely we do, we do a bit of work with some medical companies and things like that...

I   I saw something, an article I read, Ottawa Hospital in Canada.

B   Yeah.

I   They've bought a couple of thousand iPads for their staff.

B   I saw that in your research yeah. That's the way it'll go although there is one issue with a hospital compared with construction... it'll always be the case that most construction people think of drawings and they're A1/A0......and that's, you know, to look at one of them on a tab or something like that is difficult.

It`ll be a long time before we get away from the guy who is doing ... putting in the ducting for the air conditioning not using an A0 drawing, you know, and that's just the way it's going to be.

I   It`s just practical for them.

B   It's practical for them exactly. But the likes of a hospital or whatever they're looking at A4 documents, they're a lot easier to look at on ... it is and that's, you know, you're saying 3,000 iPads, that's a serious investment.

I   Definitely.

B   You know that's ... what are they? 500 quid each? Its 1½ million it's a lot of money.

I   I'm sure they might have got a discount.

B   Well possibly, possibly not knowing Apple.

I   Have you encountered any barriers like health and safety or legal issues?

B   Health and safety, no. The barriers we see, training is one, if you take again, as I was saying, you know, we have this in three main sites, there's a large airport in the Middle East and this is a site with 25,000 people on it, it's enormous.

There's a large hospital in the Middle East and again it's, compared with the planned Children's Hospital in Dublin, it's four times the size of that. It's a seven storey hospital they call it.

And then one in London called the Chard which would be the tallest building in Europe, three really big projects and the problem you have there is training so many people and especially in the Middle East. They try and get the cheaper labour to do more of the work.

So they may not have the technology background in the first place and if you're trying to train someone to use a tablet or whatever it is from first principles you're going to go up against it. If someone has a decent knowledge of...if they're used to using tablets/iPads/laptops – whatever, they're fine.

But if you're trying to start some from scratch that is sort of a problem. The cost, although people will turn around at first at how much it costs; it saves money completely.

Even against printing it saves money. If you just take the cost of printing, we have stats there where jobs you could have maybe 1.6 billion A4 pages probably printed...

I   It's crazy yeah.

B   And if you can do that without the savings right there, it's incredible. But people often complain about the cost of it but if you can get 5 minutes to talk to them, show them some figures, they'll quickly drop that one, you know.

Just so really I think training and people just being a bit scared of it.

I   It's a mindset.

B   And again I suppose a lot of people on sites are coming from maybe trade backgrounds or they didn't have computer training or whatever.

And I suppose that's a problem, people might not be up to speed and maybe a bit scared of it but again it's quite easy, the systems, as long as the input systems or what have you are easy to use sure children can do it, you know, that's it... at the end of the day.

I   Do you think site managers and so on spend so much time in the office that maybe they are neglecting stuff out on site, like managing, looking at works?

B   Yes. What I would say to that is if you take ... take this complex for example, if I'm the site manager here...and I spend a day snagging when I'm finished that day going around snagging taking my notes I spend another day trying to decipher my notes and inputting the snags into whatever...and then emailing them to people... breaking them up to the separate trades, what have you, and emailing them. So by doing ...by using tablets and that you're taking out ... it's 50% of the time.

I   Yeah, you're saving yourself staying till 10 o'clock at night sometimes.

B   Exactly, And you know, project managers or what have you, they're well paid. If you take a tablet is maybe 400 quid, say its €400. That's paid for in 2 days. So that's 4 days of snagging it's paid for itself, it's that quick. So yeah absolutely they spend way too much time on administration. There`s guys never get on site,

they sit in the office and they don't have a clue what's going on outside because they just get bogged down.

And with the health and safety procedures and all that kind of stuff they really, really do, they've got...

I   So much paperwork.

B   ... so much paperwork to do and anything you can do to help that... but the worst thing, if there's a hundred pages of paperwork that has to be done but at the moment probably most of them are being doubled up, they're being done twice somewhere, whatever it is, that's where the saving can be made, you know.

I   Yeah you mentioned you were going to show me samples.

B   Yeah I'll go through that, we'll do that afterwards. This will be the last one.

I   Grand. I was just going to ask you do you know anyone else in the industry that uses them in Ireland?

B   In Ireland? Not yet no. I'm trying to change that but not yet. Construction industry? Not tablets. People do use them but for more basic stuff for their email etc.

And you have AutoCAD; I can't remember the AutoCAD app so you can do drawings and all. People do use that but it's very much, it's a personal thing, it's not like it's a site-wide thing.

I   And you mentioned other industries, medical, was it?

B   Yeah, that's document management and inputting of information for medical devices, things like that and big pharmaceutical plants would use things like this again. Construction leads into facilities management and whether it's a building with an air conditioning unit or say in Intel, something that makes a chip, it still needs the same; there's plant preventative maintenance, there's maintenance scheduling, there's service reports and they can all be done via tablets trand they do use them, as far as I know, Intel. I've never been a fan but that's what they use, whereas it used to be, tick the box, that's it.

I   Okay. Well that's it for the formal interview.

B   That's fine, yeah. Let me know if you need anything else and if you have any follow-up on that part of it just email me afterwards and I'll let you know.

I   Okay.

B   I suppose you probably want to see some of Zutec`s work.

I   Yeah.

End of Interview

APPENDIX A.4:

KEVIN ROONEY INTERVIEW TRANSCRIPT

Kevin Rooney Interview

Interview Details / Contextualization:

Date/Time: 01/02/2012, 3pm
Interviewee: Kevin Rooney
Gender: Male
Position: Project Manager, Walls Construction
Position Held: 2010 - Present

Questions asked:

1. Do you believe that the construction industry lags behind other industries in the adoption of information technology?

2. If so, do you think this is due, in part, to the highly fragmented nature of the industry?

3. What are the main ICT tools that you, or your colleagues, use on a regular basis as part of your job?

4. Are you aware of the use of smartphones or tablet computers by your colleagues? **(Note: Smartphones can include Blackberrys, Iphones, or any internet browser connected phone)**

5. If so, can you expand on how they use these tools?

6. Are you aware of any plans by the company to use smartphones/tablets to a greater extent?

7. Do you feel that (a) whilst out on site it would be beneficial to being in touch with IT systems at all times? **And** (b) that time spent in the site office completing tasks detracts from time that could be spent supervising works on site?

8. Have you worked in the construction industry abroad? Did they embrace ICT to a greater or lesser extent than Ireland did at the time?

9. Have you recently worked in other industries? Did they embrace smartphones and tablet computers more than the construction industry?

10. Do you envisage any barriers to the adoption of smartphones/tablets in the industry?

Kevin Rooney Interview Transcript

K = Kevin Rooney
I = Interviewer [Andrew Doyle]

I   Right, so my first question is do you believe the industry lags behind other industries in the adoption of IT in general?

K   Generally I do. Absolutely. It`s Slow to change you see.

I   So I think this is due in part to the highly fragmented nature. What I mean by that is different subcontractors, loads of different parties to the contract, so it's hard to get a system in place.

K   It's hard to get a catch-all kind of thing.

I   What are the main ICT tools that you use?

K   What do mean by ICT again?

I   Just computers in general.

K   I go on the laptop really.

I   That's it.

K   And we have the wireless ... the 3G toggles whatever they're called.

I   You just update everything on the system, the Citrix or something is it?

K   They're using a Digital Management, DMS, Digital Management Systems. So it's a centralised server. It's a paperless office, everything gets uploaded, there you go.

I   Happy days. Are you aware of any of your colleagues using smartphones or tablet computers?

K   Definitely, BlackBerry's, smartphones everywhere. Are smartphone and iPhone the same thing?

I   Yeah.

K   Everywhere.

I   And do you have one?

K   And tablets I've seen. No I'm a technophobe.

I   What kind of guys are using them, other project managers or contracts managers?

K   All the contracts managers have them. All the directors have them. Nearly every subcontractor that does pricing has them.

I   Really yeah?

K   Yeah. Nearly everybody I'd say at this stage I'd say. I was told to get one and I didn't so ...But they're nearly ... like I'd say 90 per cent of people have them now.

I   Have iPhones?

K   Yeah.

I   And have you seen many people using tablets?

K   No but I have seen them. I'd say half a dozen. It seems to be creeping in.

I   In Walls or just...?

K   No, contractors.

I   Subcontractors?

K   Subcontractors.

I   Right. And can you name any that use them? It might help...

K   Well recently Capcon were in, I know they definitely had one.

I   Cabcon?

K   Capcon – C-A-P-C-O-N.

I   Okay, because I might contact them all, see how they're getting on with them, you know.

K   Well I was admiring it. I think his name was Eugene Finn. That's the one that just jumps out at the moment anyway. But you see them. IPhones everywhere, tablets creeping in.

I   Okay, number 6; are you aware of any plans by the company to bring them in for everyone?

K   No but as I said to you the smartphones...

I   You've been...

K   ... Rob told me to get one but I didn't get one and they forgot so.

I   He told you to get a personal one?

K   Get an iPhone.

I   On your own?

K   No, to order one with the company. To get rid of these. But I just think you're too contactable and they expect an answer (snaps his fingers) because it's a phone.

I   Yeah, 10 o'clock at night, respond to an email.

K   10 o'clock in the night, yeah.

I   And you're trying to avoid that.

K   I try.

I   Okay, number 7, do you feel that it would beneficial whilst out on site to be in touch with your IT systems up on a slab, updating information up on a slab rather than having to come back to the office and do it?

K   No I don't honestly think it would.

I   Not for you, no?

K   No. I think you're better off coming back to the office and sometimes you're better off having a chance to think about things and then sit down. I understand the question.

I   Yeah.

K   I understand the question because you see a lot of the things I see is at meetings now people are actually working through the meeting while they're at the meeting.

I   So they can't concentrate on one thing. Right so you don't think it's beneficial anyway for you anyway, you think people...?

K   Generally when I'm on site I'm out there because somebody is asking me a specific question......and there's nothing worse than not getting to the end of the sentence, being interrupted by phone calls and/or emails. So for my level it's unhelpful.

I   Okay.

K   Maybe some of the lads on the ground who aren't at a desk it could be more helpful to them. Because when I go to the site I'm always being asked by somebody something specific, I don't wander around ...except when I'm having to walk around and look and even then I rarely get from the office door to the site without being harassed by somebody for something so.

I   So it depends on the person so.

K   If that makes sense to you?

I   Okay, part b, that's just going on from that, the time spent in the site office detracts from time that could be spent supervising works on site.

K   It depends on your position.

I   It`s different for everyone then?

K   I manage, somebody ... you know it depends on your position. If we don't do it in the office it doesn't get done on the site.

I   ... a lot of your work is in the office anyway.

K   I'm office bound nearly, yeah.

I   So, question 8, I just listed a few things that you could do on site with smartphones or tablets...?

K   And you're not wrong. You can do that. If you're not trying to walk up the scaffold or have an electrician asking you where to do stuff.

I   Yeah.

K   Monitor the progress of jobs, I ... monitor health and safety, I appreciate what you're saying but it depends on your position. A foreman might appreciate it maybe.

I   It`s only a very new field so it's hard.

K   We actually tried to ban phones on sites.

I   Have you?

K   Because guys are going up a scaffold.

I   Safety reasons.

K   And the other reason is the guys, especially with you know these smartphones......they use the radio or the stereo or whatever it is you call it at the same time and they can't hear emergency bells.

I   So they listen to music or whatever.

K   They would listen to music and they can't hear anything. They couldn't even here if their colleague was behind them and fell and is calling for help so we've actually tried to implement phone points outside of the building, a designated phone point, same as a smoking point, that you can only use your phone there.

I   And you've brought that in on a few sites?

K   I brought it in in Inchicore towards the end and they've tried to roll it out in sites in general so that only management above a certain level could use a phone on a building site.

I   Right, well it makes sense.

I   Have you worked in the industry abroad, the construction industry recently?

K   About 3 years ago.

I   Did you notice that they were using ICT more, using IT systems more than they were in Ireland?

K   It was England.....probably yeah, probably, a little bit, a little bit.

I   Right.

K   Similar but like in fairness there was more laptops, mini laptops or whatever you call those things.

I   Netbooks?

K   There we go.

I   Have you recently worked in other industries?

K   No.

I   No? Do you envisage any barriers to the adoption of smartphones and tablets?

K   It's the safety.

I   Safety is the main thing.

K   Tablets I have to say I could see the appeal of them. I'd even ... I've a computer home and I'm thinking about replacing it with a tablet, a laptop at home as well.

I   It's big enough to see drawings on and actually do something on.

K   I think so. The ones I seen are about 7½ inch I think are they or...? You couldn't use them for a great length of time you see, like that's bad enough and that's I think ... I forget what inch it is.

I   Probably 15.

K   It's quite severe. It's 15½ I think. So the tablets they're simply too small for I'd say any more than an hour like. Safety is a big thing. You have to get your head around the safety. That's what I think is going to be the damper but certainly, you see, Rob, remember Rob?

I   Yeah.

K   He'd be promoting them because he wants to get you all the time and if you've a phone in your pocket he knows you'll get it whereas if the laptop is in the car at night you have to take it out and turn it on. So there is a big push for that but there's bit of resistance as well because people feel they're going to be enslaved and it's bad enough as it is, you know, so.

I   I heard Volkswagen Group put a ban on people being contacted after work.

K   Volkswagen, what they have done is interesting, you can be contacted an hour before you start work and a maximum of an hour after you finish work. That's it, that's company policy now.

I   It sounds like a good idea.

K   It does.   Construction is different anyway...So it's a safety thing, everything you're saying is wonderful but it's nearly too much and it's unsafe in my opinion so.

I   Do you think Rob would do an interview with me just to get a different slant on it?

K   I doubt it.

I   You doubt it?

K   If you could contact him maybe.

I   Do you have his number?

K   I'll give it to you, don't tell him I gave it to you.

I   I won't.

K   Do you want an email?

I   Yeah.

K   See Rob doesn't answer his phone. He won't answer his email.

End of Interview

APPENDIX B:

QUESTIONNAIRE DESIGN

Question 1: For the purposes of data analyses, where are you based?

This question aimed to provide the author with information about the respondent's location. This was useful information as it allowed the author to analyse how, and if, the use of and attitudes towards smartphones and tablet computers in construction varied in different regions of the world.

Respondents were given answer choices of Ireland, the UK, Europe, Middle East, North America, Oceania, Asia, South America and Africa. This covers the whole of the inhabited world with the exception of Antarctica which has no permanent residents, only scientific researchers.

There was an additional comments box at the end of this question, which allowed the respondent to clarify where exactly they are located if they wished.

Question 1 was not asked in surveys when the author was aware of the location of the respondent i.e. when the author distributed the survey amongst the top construction companies in Ireland, the United Kingdom, and the United States of America.

Question 2: For the purposes of data analyses, which of the following best describes your profession within the construction industry?

Respondents were given a list of professions from which they would choose which one best described their own profession. This allowed the author to compare responses between different professionals. There was an additional box at the end of the question which allowed the respondent to enter a profession if they could not find a suitable one from the choices provided by the author.

Question 3: Approximately what size is your company?

This question allowed the author to compare responses between company sizes. Smaller companies may have different views/practices when it comes to information technology than larger companies.

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Question 4: Do you use smartphones or tablet computers as part of your job duties?

This question gave respondents a simple choice between yes and no. A follow on question, "If yes, what tasks do you carry out with the smartphone/tablet computer?" afforded them the opportunity to expand on their answer in more detail.

Question 5: Do any of your colleagues in the construction industry use smartphones or tablet computers for their job duties?

This question followed on from the previous question and allowed the respondent to speak about their colleagues use, or not, of smartphones and tablet computers. The author felt that this was an important question because whilst the respondent may not be utilising the technology, a colleague might. Without this question valuable data may have been lost.

Upon reflection it would have been better to request further details only if the task was not already mentioned in the previous section. The author overcame this difficulty by highlighted respondents who had not commented on the previous question (using the time and date survey submitted)

Question 6: Does your company have any plans to make greater use of smartphones or tablet computers?

This question asked the respondent to note whether or not their company had any plans to adopt the technology. The answer choices were "*Yes, No and I Don`t know*". There was also a section for additional comments to allow the respondent to give further details should they wish. The author felt that this was an important question in order to get an idea whether or not companies were discussing, or indeed planning greater adoption of the technology.

Question 7: What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

Respondents were given an essay box to give their own responses to this question if they wished. This was an open ended exploratory question, with the aim of capturing professional's general views on the potential of this technology to carry out day to day tasks.

Question 8: What is the level of agreement with the following statement? "The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers"

Respondents were given a list of answer choices ranging from *Strongly Agree* to *Strongly Disagree.* A comment box was included at the end to allow respondents to further express their views on the matter should they wish. The author felt that this was an important question to ask in order to ascertain professional`s views on how the construction industry can be slow to adopt new technologies.

Question 9(Shortened version): Is too much time spent completing administrative tasks in the site office that could be carried out on site?

The question aims to make the respondents think about how administrative tasks are time consuming and can detract from issues on site. Respondents are given response choices of *Yes, No or Not Sure.* There is a section at the end of the question to allow respondents to make additional comments on the matter should they wish.

The author felt that this was a good question to ask in order to highlight time consuming administrative duties and to provoke a more detailed response from respondents.

Question 10: Do you feel it would be beneficial for engineers; construction managers etc. to be able to access information, capture data and communicate data whilst outside of their site offices?

This question follows on from the previous question and allows the respondent to give their views on the benefits of mobile information management. Again there is *Yes, No, and Not Sure* choices and an additional comments box.

Question 11: Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry?

Four barriers to the adoption of this technology are listed. Respondents were allowed to choose their agreement with all or none of these barriers. There is also a box which states *"These barriers can be overcome"* and respondents were given the opportunity to agree with this statement. There is also a box at the end which allowed the respondent to indicate other issues which are barriers to the adoption of this technology in their opinion.

Question 12: Do you feel that teaching students about the productivity benefits of smartphones and tablet computers is key to the construction industry embracing this new technology?

Respondents are given the opportunity to answer *Yes, No or Not sure*. There is a section for additional comments. The author felt that this was a salient question to ask since educational courses are often slightly behind the items and companies may suffer because of the need to train their graduates in emerging technologies.

Question 13: Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

This question afforded the respondent the opportunity to make any additional general comments about the technology which may not have been covered earlier in the questionnaire. The respondent may have further comments to make upon reflection on the survey as a whole and this section provided them with the opportunity to do this.

Question 14: Should you wish to receive the results of this survey leave your contact details below.

This section gave the opportunity for the respondent to receive the results of the survey. The author felt that the respondent may wish to be included in the results having gone to the effort of responding to the questionnaire.

Analysis of Survey Reponses

A: Companies contacted by email/website contact form

Survey	Companies Contacted	Responses	Responses as a % of companies contacted
Ireland	97	40	41%
United Kingdom	80	9	11%
United States	77	22	29%
Average			27%

Survey	*Individuals Contacted	Responses	Responses as a % of individuals contacted
Ireland	99	40	40%
United Kingdom	129	9	7%
United States	255	22	9%
Average			19%

* Individuals means survey request sent to an individuals email address as opposed to the companies general email address i.e. joebloggs@bloggsconstruction.ie as opposed to info@bloggsconstruction.ie

* Survey requests sent to company general email address may have been forwarded to many more individuals which would change the response rate

B: Questionnaire posted on LinkedIn professional networking groups

90 responses have been analysed* from the questionnaire which was posted on LinkedIn professional networking groups. It is impossible to estimate a response rate as there are thousands of members in certain groups. Only those members who choose to view the networking groups will have had the possibility of viewing and completing the questionnaire.

*12 responses received after author`s cut off date

APPENDIX C:

QUESTIONNAIRE RESULTS

APPENDIX C.1:

LINKEDIN NETWORKING GROUPS

QUESTIONNAIRE RESULTS

Increased productivity in the construction industry using smartphones and tablet computers

SurveyMonkey

1. For the purposes of data analyses, where are you based?

		Response Percent	Response Count
Ireland		29.1%	25
UK		9.3%	8
Europe		2.3%	2
Middle East		5.8%	5
North America		**36.0%**	**31**
Oceania		11.6%	10
Asia		4.7%	4
South America		0.0%	0
Africa		2.3%	2
	Additional Comments		10
	answered question		**86**
	skipped question		**4**

2. For the purpose of data analyses, which of the following best describes your profession within the construction industry?

		Response Percent	Response Count
Managing Director		**26.7%**	**23**
Contracts Manager		12.8%	11
Project Manager		22.1%	19
Quantity Surveyor		8.1%	7
Estimator		7.0%	6
Health and Safety Officer		1.2%	1
Architect		1.2%	1
Civil Engineer		5.8%	5
Structural Engineer		1.2%	1
Building Services Engineer		1.2%	1
Head office support e.g. Finance, Plant, Purchasing, Planning, Human Resources etc.		3.5%	3
Other		24.4%	21
	Other (please specify)		26
	answered question		**86**
	skipped question		**4**

3. Approximately what size is your company?

		Response Percent	Response Count
Small (1 - 24 employees)		53.9%	48
Medium (25 - 100 employees)		20.2%	18
Large (100 + employees)		25.8%	23
		answered question	89
		skipped question	1

4. Do you use smartphones or tablet computers as part of your job duties?

		Response Percent	Response Count
Yes		68.9%	62
No		31.1%	28
If yes, what tasks do you carry out with the smartphone/tablet computer?			63
		answered question	90
		skipped question	0

5. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

		Response Percent	Response Count
Yes		75.6%	68
No		7.8%	7
Not sure		17.8%	16
If yes, what do they use them for?			58
		answered question	90
		skipped question	0

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6. Does your company have any plans to make greater use of smartphones or tablet computers?

		Response Percent	Response Count
Yes		**61.1%**	**55**
No		14.4%	13
I don`t know		25.6%	23
	Additional comments		24
	answered question		**90**
	skipped question		**0**

7. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

	Response Count
	76
answered question	**76**
skipped question	**14**

8. What is your level of agreement with the following statement? "The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers."

		Response Percent	Response Count
Strongly agree		28.9%	26
Agree		**43.3%**	**39**
Neither agree nor disagree		17.8%	16
Disagree		8.9%	8
Strongly disagree		1.1%	1
	Additional Comments		15
	answered question		**90**
	skipped question		**0**

9. Do you feel that time spent by engineers, construction managers etc, in the site office detracts from time that could be spent supervising/monitoring/recording works on site? In other words is too much time spent completing administrative tasks in the site office that could be carried out on site? Example: accessing and marking up digital drawings whilst on site, taking photographs of poor workmanship and immediately emailing photo to the relevant party, etc.

		Response Percent	Response Count
Yes		**70.8%**	**63**
No		15.7%	14
Not sure		14.6%	13
	Additional Comments		13
	answered question		**89**
	skipped question		**1**

10. Do you feel it would be beneficial for engineers, construction managers etc to be able to access information, capture data and communicate data whilst outside of their site offices?

		Response Percent	Response Count
Yes		**96.6%**	**85**
No		1.1%	1
Not sure		2.3%	2
	Additional Comments		5

	answered question	**88**
	skipped question	**2**

11. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

		Response Percent	Response Count
Smartphones/Tablets prone to damage		42.5%	34
Cost of the devices		**56.3%**	**45**
Training in the use of the devices		48.8%	39
Safety issues regarding the use of the devices		13.8%	11
These barriers can be overcome		41.3%	33
	Other (please specify)		26

	answered question	**80**
	skipped question	**10**

12. Do you feel that teaching students about the productivity benefits of smartphones and tablet computers is key to the construction industry embracing this new technology?

		Response Percent	Response Count
Yes		70.0%	63
No		16.7%	15
Not sure		13.3%	12
	Additional comments		18
	answered question		90
	skipped question		0

13. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

	Response Count
	31
answered question	31
skipped question	59

14. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

	Response Count
	42
answered question	42
skipped question	48

Q1. For the purposes of data analyses, where are you based?

1	Perth WA	Mar 10, 2012 8:44 AM
2	Perth WA	Mar 10, 2012 8:44 AM
3	New Zealand	Mar 8, 2012 1:39 PM
4	New Zealand	Mar 4, 2012 4:03 PM
5	charlotte NC usa	Mar 1, 2012 2:29 PM
6	United States	Mar 1, 2012 10:45 AM
7	New Zealand	Feb 29, 2012 12:12 PM
8	Indiana	Feb 29, 2012 6:59 AM
9	South Africa	Feb 29, 2012 3:05 AM
10	I have also worked in SE Asia for 15 years.	Feb 28, 2012 12:17 PM

Q1. For the purposes of data analyses, where are you based?

Q2. For the purpose of data analyses, which of the following best describes your profession within the construction industry?

1	Technology Supplier	Mar 12, 2012 2:02 AM
2	Construction magazine editor	Mar 8, 2012 1:39 PM
3	Design Coordinator	Mar 7, 2012 3:56 AM
4	Construction Manager/Superintendent	Mar 6, 2012 6:32 PM
5	Claims consultant	Mar 5, 2012 5:21 PM
6	Architectural Technologist	Mar 5, 2012 4:09 AM
7	Sales and tech support to construction clients	Mar 4, 2012 4:03 PM
8	design	Mar 1, 2012 3:56 PM
9	Freelance Designer	Mar 1, 2012 1:46 PM
10	Business development for electrical engineering firm	Mar 1, 2012 1:02 PM
11	Owner's Representative	Mar 1, 2012 10:03 AM
12	staffing	Mar 1, 2012 7:13 AM
13	Landscape Architect	Mar 1, 2012 6:32 AM
14	General Manager	Feb 29, 2012 5:42 PM
15	manufacturers representative	Feb 29, 2012 5:26 PM
16	Developer	Feb 29, 2012 11:31 AM
17	Vice President of Operations	Feb 29, 2012 6:59 AM
18	owner - furnture design and manufacture	Feb 29, 2012 6:42 AM
19	Independent insulation consultant	Feb 29, 2012 4:29 AM
20	Director	Feb 29, 2012 1:30 AM
21	Senior Construction Manager	Feb 28, 2012 12:17 PM
22	site manager	Feb 28, 2012 12:33 AM
23	Sales Director	Feb 25, 2012 12:13 PM
24	Information Provider	Feb 24, 2012 4:33 AM
25	Sales	Feb 24, 2012 4:19 AM
26	Project Controls	Feb 22, 2012 5:29 PM

Q4. Do you use smartphones or tablet computers as part of your job duties?

1	All our work is done using iPads.	Mar 12, 2012 2:02 AM
2	I phone	Mar 10, 2012 8:44 AM
3	I phone	Mar 10, 2012 8:44 AM
4	Email / Facebook updates / Log book apps / Virtual cork board / camera / google maps / cam corder / qr code reader / voice recorder/ planner	Mar 8, 2012 1:39 PM
5	e-mail; calender; tasks; photos	Mar 7, 2012 6:03 AM
6	I can take drawings to site either on smartphone or online to view on site.	Mar 7, 2012 3:56 AM
7	E-mail Reporting Fleet Management	Mar 6, 2012 9:40 AM
8	Email	Mar 5, 2012 5:21 PM
9	Dropbox, cloud computing. Used to connect to shared files for each project.	Mar 5, 2012 4:13 AM
10	I would if i was allowed. The bosses are old school, they don't like progress.	Mar 5, 2012 4:09 AM
11	Recording of field data and our clients do the same	Mar 4, 2012 4:03 PM
12	viewing plans on PDF viewing schedules on DOC'S TO GO month end measure-up of schedule on DOC'S TO GO gps map, directions and contract location camera, recording info, job status email, web browsing for product data, engineers/city council spec	Mar 4, 2012 11:27 AM
13	Sending & receiving emails, doing drawings, checking out tender adverts in the newspapers, doing minutes during meetings with staff, taking down notes during site visit	Mar 3, 2012 12:11 PM
14	With the Smart Phone we track appointments. By year end we will be using the ipad for estimating, showing job pics, possibly contracts.	Mar 3, 2012 2:23 AM
15	Appointment Estimating Time management Follow-up on my project Agenda Contact	Mar 2, 2012 8:47 PM
16	Smartphone is used for scheduling and communication.	Mar 2, 2012 2:43 PM
17	email, document editing, address book, take pictures, text, take notes	Mar 2, 2012 2:21 PM
18	Sending/Receiving emails Internet access Camera	Mar 2, 2012 3:15 AM
19	calculations, communications, applicable applications	Mar 1, 2012 3:56 PM
20	Just taking emails	Mar 1, 2012 3:03 PM
21	smartphone only. mostly email so we can view attachements and follow links sent to us by clients. also better assists in taking and processing of photographs.	Mar 1, 2012 2:29 PM
22	I use smart phones and tablets. Mostly tablets, to take photos of the site and add measurements to the photo. Using a cloud I have the ability to pull any documents or drawings to review while I'm on the job site.	Mar 1, 2012 1:46 PM
23	Smart phones but not yet smart tablets. The phones are used for communications and administrative work. tablets are being evaluated.	Mar 1, 2012 10:45 AM

	Q4. Do you use smartphones or tablet computers as part of your job duties?	
24	I use it as a way of connecting with programs on my laptop while I am in the field. Mostly connecting and filing of pictures, creating tasks and reminders, and referencing drawings, email attachment and other documents on the job site.	Mar 1, 2012 10:03 AM
25	site evaluations (solar contractor) Satellite imagery web based estimating tools email	Mar 1, 2012 9:19 AM
26	Reading emails, cell phone, looking up information on the internet. These are particularly handy during meetings where we need to reference a document that was sent by email, or a photo that was taken of a site condition.	Mar 1, 2012 8:47 AM
27	Email usage while traveling.	Mar 1, 2012 7:55 AM
28	E-mail responses Site Viedos and photos Conference calling Review and annotation of drawings Plan/Powerpoint presentations Geo-spatial imaging	Mar 1, 2012 6:32 AM
29	Checking emails while away from the office, calendar management, meeting minutes.	Mar 1, 2012 6:07 AM
30	email, marketing, facebook, twitter, linkedin, Calls, pictures, text.	Mar 1, 2012 2:31 AM
31	Read and to some degree respond to email	Mar 1, 2012 1:58 AM
32	Sending drawings, AI's etc to our site managers	Feb 29, 2012 5:46 PM
33	email quotes gps mapping to find sites photographs/gps Internet search	Feb 29, 2012 5:42 PM
34	smartphone email, view doc's	Feb 29, 2012 5:26 PM
35	E-mail correspondence; Board papers (through Dropbox and Good reader); google searching	Feb 29, 2012 3:13 PM
36	Data entry, scoping of works,	Feb 29, 2012 12:12 PM
37	Many of our Project Management systems are web based so I can review, comment or approve work product through the smartphone devices. I track all meeting and travel on my smartphone. I also have the ability to dowload and view documents and BIM models on my tablet. Most of the communication during the day when traveling is through e-mail in lieu of a phone call.	Feb 29, 2012 6:59 AM
38	Calander e-mails some data	Feb 29, 2012 6:47 AM
39	Utilize smart phone for email, contact management, calendar, photographs.	Feb 29, 2012 5:58 AM
40	phone, internet, and presentations	Feb 29, 2012 5:15 AM
41	Safety Inspection data collection	Feb 29, 2012 4:45 AM
42	Take images of poorly fitted insulation and publish so the general public can see there needs to be strict inspection on every build.	Feb 29, 2012 4:29 AM
43	I find Evernote the best way of taking and keeping notes We use BBM (Blackberry messaging) All company correspondence is done and sent on tablets/iPads/Smartphones	Feb 29, 2012 3:05 AM

Q4. Do you use smartphones or tablet computers as part of your job duties?

44	Assigning of tasks and communication between supervisors. Also to relay materials lists internally as well as with suppliers.	Feb 29, 2012 1:57 AM
45	email	Feb 29, 2012 1:23 AM
46	To track emails and retrieve data files etc.	Feb 29, 2012 12:32 AM
47	Reports Photos Reminders Schedules Email access	Feb 28, 2012 11:38 PM
48	email, messaging, crm, photos	Feb 28, 2012 2:19 PM
49	Email, LinkedIn, Twitter, blogging	Feb 28, 2012 1:53 PM
50	We use Blackberry phones. Some of us have bought our own tablets so that we can carry the drawings around with us in the field.	Feb 28, 2012 12:17 PM
51	e-Mail Internet Planning/Scheduling Pictures Phone	Feb 28, 2012 6:41 AM
52	Snagging, Commissioning	Feb 28, 2012 2:36 AM
53	Email, Twitter, photos, video, phone calls, diary, contacts, some drawing access (use AutoCAD WS occasionally, and some browser-based access to project collaboration tools)	Feb 28, 2012 1:28 AM
54	email retrieval on the move . also used as connection for pc to network. murphys just started issuing smart phones to staff but not tablets.	Feb 28, 2012 12:33 AM
55	Mainly for Internet, email and social media. I do use conversion apps from time to time also.	Feb 27, 2012 4:47 PM
56	Scheduling work for the week, keeping notes, searching the internet, keeping records	Feb 27, 2012 4:20 AM
57	E-mails, calendar	Feb 26, 2012 5:18 PM
58	I use it to check orders coming in to the office and also for emailing.	Feb 25, 2012 12:13 PM
59	Camera Email Messaging Phone (with and without bluetooth) SatNav Maps Website Search Use as internet connection for laptop (in rare case of necessity)	Feb 24, 2012 8:42 AM
60	E-mail and meeting scheduler, quick research	Feb 24, 2012 3:46 AM
61	email	Feb 23, 2012 4:54 AM
62	Update the schedule Communicate project changes Timesheets Site Planning	Feb 22, 2012 5:29 PM
63	Quotations, Email, Expenses, H&S Questionnaires, Engineer Reporting	Feb 17, 2012 1:30 AM

Q5. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?			
1	Our mobile apps are being used by our clients to present their company portfolio's on the move including projects and now products.	Mar 12, 2012 2:02 AM	
2	On site access to drawings and emails	Mar 10, 2012 8:44 AM	
3	On site access to drawings and emails	Mar 10, 2012 8:44 AM	
4	Condition survey	Mar 7, 2012 4:03 PM	
5	e-mail; calender; tasks; meeting minutes; photos; punch lists	Mar 7, 2012 6:03 AM	
6	Email, ipads used for reviewing docs, personal document storage/management (minutes of mtgs etc)	Mar 5, 2012 5:21 PM	
7	To get best prices in material in the internet and track project progress	Mar 5, 2012 6:05 AM	
8	As above all mamagement staff have Iphones with dropbox facilities	Mar 5, 2012 4:13 AM	
9	wasting time, misreading emails and poor phone quality.	Mar 4, 2012 1:39 PM	
10	as above	Mar 4, 2012 11:27 AM	
11	mainly checking emails, some for viewing drawings.	Mar 4, 2012 1:33 AM	
12	Presentations, appointments, estimating.	Mar 3, 2012 2:23 AM	
13	Smartphones are used for scheduling and communication.	Mar 2, 2012 2:43 PM	
14	same as above	Mar 2, 2012 2:21 PM	
15	calculations, communications, applicable applications	Mar 1, 2012 3:56 PM	
16	Taking notes during meetings, staying in contact	Mar 1, 2012 1:02 PM	
17	Many of my contemporaries use tablets for reporting, estimating and other administrative work.	Mar 1, 2012 10:45 AM	
18	It has been limited. Tablets have not made it to the field yet on my projects. The smartphones are being used much as I described above.	Mar 1, 2012 10:03 AM	
19	Similar to my use	Mar 1, 2012 9:19 AM	
20	Emails, cell phone & internet access. Use at meetings for referencing documents or correspondence or viewing photos of site conditions being discussed.	Mar 1, 2012 8:47 AM	
21	mostly e-mail and for photographing projects to share with our team via multi-media messages.	Mar 1, 2012 8:28 AM	
22	Email mostly	Mar 1, 2012 7:55 AM	
23	Same as above for design professionals	Mar 1, 2012 6:32 AM	
24	See above.	Mar 1, 2012 6:07 AM	
25	Same as above	Mar 1, 2012 2:31 AM	
26	Read and to some degree respond to email	Mar 1, 2012 1:58 AM	

Q5. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

27	same as me	Feb 29, 2012 5:42 PM
28	The above Techncial field staff - live recording of field data	Feb 29, 2012 3:13 PM
29	Ditto	Feb 29, 2012 12:12 PM
30	Same.	Feb 29, 2012 6:59 AM
31	not sure	Feb 29, 2012 6:47 AM
32	email correspondence, reminders	Feb 29, 2012 6:42 AM
33	Marking up drawings in field, QA/QC. Some jobs are piloting software such as Vell and Latista for RFI's, QA/QC, punchlist. A lot of users are note taking with tablets.	Feb 29, 2012 5:58 AM
34	Internet research of complex safety topics	Feb 29, 2012 4:45 AM
35	Email and images	Feb 29, 2012 4:29 AM
36	e-mails - send and receive SMS's	Feb 29, 2012 3:05 AM
37	email	Feb 29, 2012 2:52 AM
38	email	Feb 29, 2012 1:56 AM
39	emil	Feb 29, 2012 1:23 AM
40	Ditto	Feb 29, 2012 12:32 AM
41	Same , less on reports	Feb 28, 2012 11:38 PM
42	email, messaging, crm, photos	Feb 28, 2012 2:19 PM
43	Same	Feb 28, 2012 1:53 PM
44	drawings, specs and punch list compilation	Feb 28, 2012 12:17 PM
45	e-Mail Internet Planning/Scheduling Pictures Phone	Feb 28, 2012 6:41 AM
46	Snagging, Commissioning	Feb 28, 2012 2:36 AM
47	as above (but probably not Twitter)	Feb 28, 2012 1:28 AM
48	the same purpose	Feb 28, 2012 12:33 AM
49	Similar to above	Feb 27, 2012 4:47 PM
50	Same as above	Feb 27, 2012 4:20 AM
51	Same - e-mails and calendar, some use tablets for drawings	Feb 26, 2012 5:18 PM
52	Same as myself	Feb 25, 2012 12:13 PM
53	internet, phone, some typing of records	Feb 25, 2012 5:47 AM
54	No idea but similar use - one presumes	Feb 24, 2012 8:42 AM

Q5. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

55	Sales, industry analysis	Feb 24, 2012 4:33 AM
56	Arranging meetings	Feb 24, 2012 4:19 AM
57	same	Feb 24, 2012 3:46 AM
58	email and sms	Feb 23, 2012 4:54 AM

	Q6. Does your company have any plans to make greater use of smartphones or tablet computers?	
1	We are always looking at new technology and what benefits it offers.	Mar 12, 2012 2:02 AM
2	We are using a system supplied by buildtools (BT Connect)	Mar 10, 2012 8:44 AM
3	We are using a system supplied by buildtools (BT Connect)	Mar 10, 2012 8:44 AM
4	Expanding the use of tablets	Mar 7, 2012 6:03 AM
5	Possibly depending on what happens to RIM	Mar 6, 2012 10:32 AM
6	I've been trying for years to encourage the use of smartphones and ICT.	Mar 5, 2012 4:09 AM
7	tablets for contract documents and selections and changes in the field	Mar 1, 2012 3:56 PM
8	I'm constantly looking for apps to install on my tablet to increase productivity.	Mar 1, 2012 1:46 PM
9	We don't have the budget for it.	Mar 1, 2012 1:02 PM
10	tablets are being evaluated,but I use my own personal tablet on the job.	Mar 1, 2012 10:45 AM
11	We are constantly looking for connectivity and collaboration solutions to relay communications. Primary issues with the different platforms is that they are using different operating systems and so programs used on one platform are either not available to don't have the same functionality on the others. Another issue is computing power on some of the portable devices is too low to be able to look at 3D models or other CADD documents.	Mar 1, 2012 10:03 AM
12	I can easily foresee Jobsite Superintendents Using Tablet Computers. Many already have Smart Phones.	Mar 1, 2012 6:07 AM
13	maybe as presentation tools?	Feb 29, 2012 5:42 PM
14	We continue to increase the useage of tablets. We recently started to use a web based P6 scheduling module that can be viewed and updated on the tablets.	Feb 29, 2012 6:59 AM
15	We're in contract with a phone company waiting for contract to expire. Smart phones presently supplied not up to use	Feb 29, 2012 6:42 AM
16	We have developed an insulation software program for the builder and enduser to make it easier to understand the benefits of the product performance before choosing a brand.	Feb 29, 2012 4:29 AM
17	We have tried evernote for site reports, has potential	Feb 28, 2012 11:38 PM
18	Constant contact is essential	Feb 28, 2012 1:53 PM
19	All data for construction to be passed this way	Feb 28, 2012 2:36 AM
20	Need more apps, esp on Android platform	Feb 28, 2012 1:28 AM
21	due to cost / damage ratio	Feb 28, 2012 12:33 AM
22	Only use smart phones at present	Feb 26, 2012 5:18 PM
23	Business is v. bad so no spare funds available for such expansion	Feb 24, 2012 8:42 AM
24	to use social business software applications and site based electronic forms	Feb 23, 2012 4:54 AM

Q7. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

1	Fundamentally, they can replace the need for printed materials helping professionals access and share important drawings and technical data needed to get decisions made and tasks completed. This offers a sustainable and more modern alternative.	Mar 12, 2012 2:02 AM
2	Inspection of works completed and ref drawings on site. Fast rfi submissions as they develop on site. Instant update of ceding documents.	Mar 10, 2012 8:44 AM
3	Inspection of works completed and ref drawings on site. Fast rfi submissions as they develop on site. Instant update of ceding documents.	Mar 10, 2012 8:44 AM
4	Valuation Appraisal Condition survey Progress reporting WiP Energy Monitoring Reference - BIM/DWG Snagging	Mar 7, 2012 4:03 PM
5	e-mail; calender; tasks; meeting minutes; photos; punch lists; documents	Mar 7, 2012 6:03 AM
6	Design alterations from site checks or meeting comments. Survey details can be drawn or overlaid.	Mar 7, 2012 3:56 AM
7	Checking drawings/information on site, snagging, making notes similar to voice recorder	Mar 6, 2012 6:32 PM
8	estimates, cost plus reportss, scheduling	Mar 6, 2012 10:32 AM
9	Schedule Updates Design Changes Change Order management Handle RFI's Production Reporting	Mar 6, 2012 9:40 AM
10	Any task in the construction project will be faster using the smartphones and tablet because we will track the project progress with the general foreman and any ploblem with the progress we cant solve faster by using this thecnology	Mar 5, 2012 6:05 AM
11	Any thing that could have been done in the past with hard files. For example programme update on the ground, a photo is taken with the % complete this information is then uploaded onto the software and the programme can then be issued to all.	Mar 5, 2012 4:13 AM
12	Photos records and comments Calendar syncing updating File access through the cloud Video calling Augmented Reality Solutions the possiblities are endless....	Mar 5, 2012 4:09 AM
13	Data Capture with live synchronisation	Mar 4, 2012 4:03 PM
14	making mistakes.	Mar 4, 2012 1:39 PM
15	there is a lack of construction management apps options, have looked over HUROV's construction apps. bit expensive, have not yet bought it.	Mar 4, 2012 11:27 AM
16	schedules, updates, sharing information. Knowledge management.	Mar 4, 2012 1:33 AM
17	JOb tracking, presentations, change orders using Dropbox, estimating, CRM duties.	Mar 3, 2012 2:23 AM
18	Quick estimating Project management on site Surintendant mangement	Mar 2, 2012 8:47 PM
19	Scheduling, communication, maps, internet search.	Mar 2, 2012 2:43 PM

	Q7. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?	
20	Take notes and quickly file them	Mar 2, 2012 2:21 PM
21	contract documents and selections and changes in the field	Mar 1, 2012 3:56 PM
22	Tablets could be used for carrying drawings we could zoom in and out of details etc	Mar 1, 2012 3:03 PM
23	tablet computers are great for product selections and photos. also, can update and change contracts during sales. close the deal faster	Mar 1, 2012 2:29 PM
24	Marking up drawings that can be electronically transferred to the workstation. Taking notes, photographs, video recordings and audio input to better explain site conditions. This allows others to start working on solutions now rather than waiting for me to get back into the office.	Mar 1, 2012 1:46 PM
25	Notes from meetings Email updates/project coordination Web research Photographs of sites	Mar 1, 2012 1:02 PM
26	Reports, invoicing, estimates.	Mar 1, 2012 10:45 AM
27	Ultimately, anything that can be done on a desktop or laptop machine should be able to be done to some degree on a tablet or smartphone. Limitations of input devices and wifi connectivity will be major issues.	Mar 1, 2012 10:03 AM
28	respond to email prep for meeting artistic renderings to be brought to a meeting	Mar 1, 2012 9:19 AM
29	Sending photos to the architect/engineer of a site condition that needs correction or attention, and requesting information. Calling from the car to set up an appointment that was asked for at a meeting or logging in meetings onto the calendar. Sending in reports that were prepared in the field.	Mar 1, 2012 8:47 AM
30	change order processing, materials procurement, manpower tracking, job costing	Mar 1, 2012 8:28 AM
31	??	Mar 1, 2012 7:55 AM
32	Staying connected to the office and e-mails and documents	Mar 1, 2012 7:13 AM
33	E-mail responses Site Viedos and photos Conference calling Review and annotation of drawings Plan/Powerpoint presentations Geo-spatial imaging	Mar 1, 2012 6:32 AM
34	Staying in touch with easy access to emails containing submittals, change orders, construction docs, etc.	Mar 1, 2012 6:07 AM
35	design , presentation,video. problem solving.	Mar 1, 2012 2:31 AM
36	Record inspections and incidents. Approver / reject work	Mar 1, 2012 1:58 AM
37	Checking construction drawings for information. Access and review 3D/BIM model. Preparation of Method Statements Completing Quality Checksheets e.g pre-pour inspections. Photograhs and emailing technical queries Maintain Records of Labour, Plant and materials Raising orders for materials and plant	Mar 1, 2012 12:27 AM
38	Tablets & smart phones make site meetings easier as you don't have to	Feb 29, 2012 5:46 PM

Q7. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

	carry numerous folders, drawings etc.	
39	as for Q4 above	Feb 29, 2012 5:42 PM
40	show doc's, spreadsheets, videos	Feb 29, 2012 5:26 PM
41	E-mail Quoting Sales proposals Remedial - identification and communciation of proposed solution Construction - variations	Feb 29, 2012 3:13 PM
42	Great for undertaking and recording small works without the need to return to the office	Feb 29, 2012 12:12 PM
43	Daily Report, Progress Photos, As-built records, Snagging / Defects	Feb 29, 2012 11:31 AM
44	Drawing review & markup, shop drawing review & markup	Feb 29, 2012 7:20 AM
45	All the checklists (safety, quality, production, punchlist, MEP coordination, etc. Many of the staff that use public transit use the smartphones to catch up on e-mails.	Feb 29, 2012 6:59 AM
46	It will save time if a tablet is given to the each head of execution team. (depending upon the need) They will not have to carry large drawings to understand the scope/complexity of work. Interpretation of data will be more easier.	Feb 29, 2012 6:57 AM
47	we would expect to move all our administration off our local PC and use cloud computing in order to access material all the time	Feb 29, 2012 6:42 AM
48	QA/QC, BIM review and verificaiton, Pictures, RFI's in field, note taking, etc..	Feb 29, 2012 5:58 AM
49	pictures, reports, schedules, RFI's	Feb 29, 2012 5:15 AM
50	Quality assurance Checks and documentation	Feb 29, 2012 4:45 AM
51	Inspection and checking of insulation results to ensure the correct materials are applied.	Feb 29, 2012 4:29 AM
52	Sketches done and sent directly SMS's e-mail - send and receive	Feb 29, 2012 3:05 AM
53	Tablets can be of great use in creating daily reports while in the field and take pictures on you tablet and immediately attach, as well as getting daily weather reports on the go.	Feb 29, 2012 1:57 AM
54	email, data overview, report overview	Feb 29, 2012 1:56 AM
55	Coordination, Planning and Reporting	Feb 29, 2012 1:30 AM
56	Wider use for better dissemination of information	Feb 29, 2012 12:32 AM
57	Site quality checking/ progress reporting/ health and safety	Feb 28, 2012 11:38 PM
58	record keeping (text and photos), customer data, email	Feb 28, 2012 2:19 PM
59	Any! With the power of WiFi, the internet & remote desktop, anything can be done from anywhere!	Feb 28, 2012 1:53 PM
60	I find them very useful in the field. In transit, my laptop will do.	Feb 28, 2012 12:17 PM

Q7. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

61	Don't know	Feb 28, 2012 11:54 AM
62	e-Mail Internet Planning/Scheduling Pictures Phone	Feb 28, 2012 6:41 AM
63	Snagging, Commissioning, reviewing, viewing data	Feb 28, 2012 2:36 AM
64	Smartphones/tablets are almost tailor-made for inspection-type work - defects snagging, health & safety, etc. A lot of routine drawing issue/receipt management could also be managed online	Feb 28, 2012 1:28 AM
65	everything from checking drawings electronucally to marking as built drawings	Feb 28, 2012 12:33 AM
66	Site records Drawing viewers GIS	Feb 27, 2012 4:47 PM
67	Record keeping	Feb 27, 2012 4:20 AM
68	With the smart phones, there is no delay in making sure the correct information is transferred to site and that the construction team are working to the latest info/drawings.	Feb 26, 2012 5:18 PM
69	email, costing.	Feb 26, 2012 3:29 AM
70	All of the above listed - and many others too many to mention	Feb 24, 2012 8:42 AM
71	Bill of Quantities, On site surveying,	Feb 24, 2012 4:33 AM
72	>Design analysis >Damage control >Identify relevant contacts & companies (Peter Daly from Modern Builder Software will be able to help you with this, find him on LinkedIN)	Feb 24, 2012 4:19 AM
73	site diary updates form based reporting (HSEQ)	Feb 23, 2012 4:54 AM
74	Update the schedule Communicate project changes Timesheets Site Planning Material receipting	Feb 22, 2012 5:29 PM
75	As technology advances the possibilities are endless. I would like to see on site incidents recorded into a cloud through either of the devices linking it instantly to any instances which occur.	Feb 20, 2012 10:58 AM
76	A lot more. Greater use of apps for specific tasks.	Feb 17, 2012 1:30 AM

Q8. What is your level of agreement with the following statement?

"The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers."

1	Having email and able to view office files exist, but tablets need to be pushed more, its to cumbersome to take laptops on site. But laptops and tablets are not always accepted to be taken into PPE zones on some sites.	Mar 7, 2012 3:56 AM
2	They only tend to adopt technology they have been shown and is proven and then this can take time as well as it is unlikely to happen in the middle of a project.	Mar 4, 2012 4:03 PM
3	you have to establish that there is an advantage before one might say there is a lag!	Mar 4, 2012 1:39 PM
4	Very few tablets in use in the construction industry	Mar 3, 2012 12:11 PM
5	this is especially true in residential but those who embrace it are better off. our clients embrace this technology so we find it helps us communicate on a more comfortable level with them.	Mar 1, 2012 2:29 PM
6	Construction industries are slow to adopt new systems. We have some sub-contractors that still do not use email. Having these entities try to keep up with the purchase and training for new hardware and software, especially for some trades, is not seen as a productive investment.	Mar 1, 2012 10:03 AM
7	It is only in the past year that I have witnessed use of these devices as a tool at meetings. A very handy tool that has saved time in certain situations and helped to move a project along.	Mar 1, 2012 8:47 AM
8	The construction industry ALWAYS lags behind in technology...dating back to the acceptance of the fax machine!	Mar 1, 2012 6:07 AM
9	Probably not true in New Zealand but I don't really know	Feb 29, 2012 5:42 PM
10	Most changes in the industry take a long time to implement.	Feb 29, 2012 6:59 AM
11	Our software is a very user friendly package but unfortunately our construction sector [Builders] are used to pen and paper.	Feb 29, 2012 4:29 AM
12	I believe this is partially due to the lack of relevant apps available from developers. There are many construction calculators out there, but very few real Project Management applications.	Feb 29, 2012 1:57 AM
13	Having done work in several countries, the gaps between them are amazing. It baffles me...	Feb 28, 2012 1:53 PM
14	From my experience companies adapt when required	Feb 26, 2012 5:18 PM
15	The construction industry in on its knees. It smacks of semantics (look it up) to	Feb 24, 2012 8:42 AM

Q9. Do you feel that time spent by engineers, construction managers etc, in the site office detracts from time that could be spent supervising/monitoring/recording works on site?

In other words is too much time spent completing administrative tasks in the site office that could be carried out on ...

1	It's a history record that all sites need, as we live in a blame culture, you need to have evidence for all rights & wrongs!	Mar 7, 2012 3:56 AM
2	Definitely !!!!, inparticularly here in Qatar were paper mountains are created !!!	Mar 6, 2012 6:32 PM
3	We have had this exact discussion this week.	Mar 5, 2012 4:09 AM
4	Smart phones and tablets give you the ability to have your office and office staff virtually on-site with you at all times.	Mar 1, 2012 1:46 PM
5	The down side is that we have become an email society. Construction managers on site spend a lot of time now responding to emails where a simple phone call with a follow up facsimile with confirmation of the discussion would have been sufficient before.	Mar 1, 2012 8:47 AM
6	Way too much admin time is spent	Feb 29, 2012 5:42 PM
7	We look for software programs to adopt that limit the time away from the field and encourage our staff to remain in the field while using the tablets.	Feb 29, 2012 6:59 AM
8	While the above can be very helpful, the immediacy of it can cause friction particularly between contractors. Sometimes it needs time to put distance and perspective on issues	Feb 29, 2012 6:42 AM
9	You hit the nail on the head with that question	Feb 29, 2012 4:29 AM
10	However, I am still partial to viewing full size hard-copies of drawings.	Feb 29, 2012 1:57 AM
11	The works in the site office is as important as monitoring and recording works on site	Feb 26, 2012 5:18 PM
12	Absolutely	Feb 25, 2012 5:47 AM
13	Reason for ticking No is to make known my annoyance at such an open-ended question. You may as well ask if engineers, construction managers etc generally spend too much time at meetings in Head Office, or on the phone or talking generally.	Feb 24, 2012 8:42 AM

Q10. Do you feel it would be beneficial for engineers, construction managers etc to be able to access information, capture data and communicate data whilst outside of their site offices?

1	The more access one has to information, the less likely of having misunderstandings.	Mar 1, 2012 1:46 PM
2	Yes, we do this through web based project management systems. This allows access through any web portal.	Feb 29, 2012 6:59 AM
3	There would be more visual inspection	Feb 29, 2012 4:29 AM
4	However, much of this communication can be done via cell phone to an extent.	Feb 29, 2012 1:57 AM
5	As noted previously, this ability would vastly reduce the time between the engineer receiving the information and conveying to the construction team	Feb 26, 2012 5:18 PM

Q11. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

1	Understanding how they can improve the bottom line. Simply not embracing change and new technology.	Mar 12, 2012 2:02 AM
2	Time can be saved = cost savings	Mar 10, 2012 8:44 AM
3	Time can be saved = cost savings	Mar 10, 2012 8:44 AM
4	Integration with process	Mar 7, 2012 4:03 PM
5	Training and change would be the biggest concern. Old habits die hard.	Mar 5, 2012 4:13 AM
6	Old people in control of companies that don't understnad the benefits. PS: i'm 35 I'm talking about lads in their 50-60 that struggle with email.	Mar 5, 2012 4:09 AM
7	small screens means people make mistakes and are in a hurry to use them without considered responses or recording and therefore lead to miscommunication and errors	Mar 4, 2012 1:39 PM
8	Training and implementing programs. Also, carrying around a tablet or ipad can be cumbersome. Everything has to tie back in to a central company portal of information.	Mar 3, 2012 2:23 AM
9	Pen and paper are still faster methods to capture creativity.	Mar 2, 2012 2:43 PM
10	Connectivity on construction sites will have to be via wifi. Too often, the costs for these systems on a temporary basis across a large job site would be prohibitive. And given the fact that as the job progresses, the system will need to be maintained and moved to remain useful is a serious issue.	Mar 1, 2012 10:03 AM
11	In NZ the cost of data is high but when the benefits are analysed it is worth it even now	Feb 29, 2012 5:42 PM
12	industry provide the app, and the rest will follow	Feb 29, 2012 5:26 PM
13	Finding the right software that fits the need is the bigger challenge.	Feb 29, 2012 6:59 AM
14	Reluctance of industry to change	Feb 29, 2012 6:47 AM
15	Integrating devices to software used in house (Microsoft, CMiC, etc..)	Feb 29, 2012 5:58 AM
16	Training Training Training	Feb 29, 2012 4:29 AM
17	As mentioned before, the lack of good appliactions on the market.	Feb 29, 2012 1:57 AM
18	convenience	Feb 29, 2012 1:56 AM
19	Screens too small to view drawings	Feb 29, 2012 1:23 AM
20	Resistance to current methods being changed by the "older" generations. The onld saying "if it aint broke, dont fix it"	Feb 28, 2012 1:53 PM
21	Unwillingness to change	Feb 28, 2012 2:36 AM
22	Not enough awareness of construction related apps	Feb 27, 2012 4:47 PM
23	Awerness of capability	Feb 27, 2012 4:20 AM

Q11. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

24	All of the above, but used in the right manner they can be overcome	Feb 25, 2012 12:13 PM
25	Mainly cost and senior management buy in	Feb 25, 2012 5:47 AM
26	Change - doing things different	Feb 22, 2012 5:29 PM

Q12. Do you feel that teaching students about the productivity benefits of smartphones and tablet computers is key to the construction industry embracing this new technology?

1	But you still have to get management to adopt the technology, often incoming student get ignored and told to just do it as we have always done it!	Mar 4, 2012 4:03 PM
2	On condition that the "first principles" are not lost in process of going hi-tec.	Mar 4, 2012 11:27 AM
3	say what you will about productivity benefits it is also a distraction. you arent paying attention to your job while you are checking emails from the hip. however the benefits of this tool outweigh the drawback.	Mar 1, 2012 2:29 PM
4	Most of the people I compete with are reluctant to pay for training. Figuring that if they train someone then they'll leave and go somewhere else .I guess my point is, they're willing to hire someone with these qualities, but not pay for them to be trained. I tell them... not everybody needs to be trained, only those that need to be productive...but this statement usually just goes over there head.	Mar 1, 2012 1:46 PM
5	Need to be teaching managers/owners in the industry. Students already know the benefits.	Mar 1, 2012 1:02 PM
6	Would probably help but adoption in this industry is fast anyway	Feb 29, 2012 5:42 PM
7	Applies to all disciplines	Feb 29, 2012 6:42 AM
8	I think today's students are self educated in the technology presently available.	Feb 29, 2012 5:15 AM
9	I thhink having benificial software at a cost that is worth it will be key	Feb 29, 2012 4:45 AM
10	Students learn the importance of technology while in school, regardless of the field of study.	Feb 29, 2012 1:57 AM
11	It is essential	Feb 28, 2012 1:53 PM
12	Also need to teach many existing staff about benefits	Feb 28, 2012 1:28 AM
13	Learn early!	Feb 27, 2012 4:47 PM
14	Its the manager's/accountants that need to be shown the productivity benefits.	Feb 26, 2012 5:18 PM
15	You don't need to teach students about the (blindingly) obvious benefits of smart-phones/tablets.	Feb 24, 2012 8:42 AM
16	The key is teaching the senior staff	Feb 24, 2012 3:46 AM
17	The key is encouraging and changing the decision makers in the industry. Of course training students will be beneficial for driving change in 15 years time.	Feb 22, 2012 5:29 PM
18	Many students wil be familiar with the technology; however, the direct benefits to the work place will not be recognised. Whether this should be education through schooling or the work place I am unsure.	Feb 20, 2012 10:58 AM

Q13. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

1	I'd very much like to see the results of this survey and would be interested in collaborating in future research in this area. Please contact me if you'd like us to use our network to help promote this survey.	Mar 12, 2012 2:02 AM
2	Autodesk has started to open things up with WS and apps for iOS & Android. Just need to open up mobile data allowances and speeds.	Mar 7, 2012 3:56 AM
3	Applications need to be developed and marketed to company's proving savings, time saved, etc.	Mar 6, 2012 9:40 AM
4	Yes, will be a better way to accelerate any construction task using this thecnology	Mar 5, 2012 6:05 AM
5	It is the way forward and we are someway along that road. However what technology can do for the industry is endless and should be embraced by all	Mar 5, 2012 4:13 AM
6	Get the programmers working on more APPS.	Mar 4, 2012 11:27 AM
7	no	Mar 4, 2012 1:33 AM
8	No	Mar 2, 2012 2:43 PM
9	Health and safety issues I believe will limit their use as we will not be allowed walk round a site with heads buried into phones or tablets	Mar 1, 2012 3:03 PM
10	It's the way of the future. You either embrace it and move with it, or you spend a lot of valuable time consequently, trying to catch up to it.	Mar 1, 2012 1:46 PM
11	More and more it will come into affect, especially with smaller firms. They have to work from thier vehicles many times, and these devices are a great assist.	Mar 1, 2012 10:45 AM
12	20 years ago we worked with pagers for communication. Nowadays I can connect with a variety of information and services via my smartphone. What I can bring to a meeting can now be carried in a small tablet, rather than a multitude of files	Mar 1, 2012 9:19 AM
13	No	Mar 1, 2012 8:47 AM
14	While there is no doubt that these devices have greatly increased productivity during what was typically down time (i.e. driving to and from sites, meetings, commuting, etc.) and service to the client, the expectation by the client that tasks will be done immediately is a little disturbing at times. Contact is almost expected 24/7 which can be frustrating to both the professional whose off-hours are being interrupted, and the client who wants to discuss projects at their convenience.	Mar 1, 2012 6:32 AM
15	No	Mar 1, 2012 12:27 AM
16	no	Feb 29, 2012 5:42 PM
17	It's not about teaching "students"... the young guys are already up to speed on the technology. The problem is the older guys who are not interested in putting in the time (which they see as a waste of time) in order to properly learn the benefits. Also, no one wants to put up money for expensive tech equipment that is prone to damage on a construction site where everything is prone to damage.	Feb 29, 2012 7:20 AM

Q13. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

18	The introduction of tablet computers would enable the engineer or site foreman to show images to the builder to clarify any on site issues.	Feb 29, 2012 4:29 AM
19	software updation	Feb 29, 2012 1:56 AM
20	Devices of these types will revolutionize & streamline the industry	Feb 28, 2012 1:53 PM
21	No	Feb 28, 2012 11:54 AM
22	BIM will have major impact on reliability of information shared. Industry will also need to get used to more real-time data, and not just rely on conventional asynchronous communications.	Feb 28, 2012 1:28 AM
23	design them to be more robust	Feb 28, 2012 12:33 AM
24	It literacy is poor among certain age groups hence the adoption of new IT initiatives will be slow until the current cohort of industry members change	Feb 27, 2012 4:20 AM
25	The smart phone is essential in the construction industry, especially in this climate when companies/projects cannot afford to wait for critical information and the timely receipt of same can make a huge difference on a building site.	Feb 26, 2012 5:18 PM
26	Currently developing a device with app for the construction industry	Feb 26, 2012 9:43 AM
27	no	Feb 26, 2012 3:29 AM
28	Their use will increase - jsut s night follows day.	Feb 24, 2012 8:42 AM
29	recent studies showed that young professionals are using consumer software/freeware and their personal hardware to complete their work activities	Feb 23, 2012 4:54 AM
30	I believe they are important for the future of teh construction industry improving efficiency; especially with regard to BIM	Feb 20, 2012 10:58 AM
31	Good luck with thesis. If you could send on the results it would be appreciated tkinane@thermodial.ie	Feb 17, 2012 1:30 AM

Q14. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

1	ryan@woobius.com - 07983 506928	Mar 12, 2012 2:02 AM
2	Cboland@southerncrossgroup.net	Mar 10, 2012 8:44 AM
3	Cboland@southerncrossgroup.net	Mar 10, 2012 8:44 AM
4	rcovich@tradergroup.co.nz	Mar 8, 2012 1:39 PM
5	rknowles@JVSchafer.com	Mar 7, 2012 6:03 AM
6	ndfarrimond@yahoo.co.uk	Mar 6, 2012 6:32 PM
7	Ye I will like to receive the results of this survey. Email. rafael0817@hotmail.com	Mar 5, 2012 6:05 AM
8	Yes I would like a copy of the results. joshaughnessy@clancyconstruction.ie	Mar 5, 2012 4:13 AM
9	Please send the results to: Lawrence.Lewis@GeoSystems.co.nz	Mar 4, 2012 4:03 PM
10	doug@trenchingdynamix.co.nz	Mar 4, 2012 11:27 AM
11	yes please. Darren O Gorman darren@targetzero.ie	Mar 4, 2012 1:33 AM
12	nyabsp@yahoo.com	Mar 3, 2012 12:11 PM
13	ALAN.BAKERSR@BACORP1.COM	Mar 1, 2012 3:56 PM
14	Vincent@keeganquarries.com	Mar 1, 2012 3:03 PM
15	Dan Williams dwilliams100@nc.rr.com	Mar 1, 2012 1:46 PM
16	just post them in this LinkedIn group when completed.	Mar 1, 2012 10:03 AM
17	thomascloredo@aol.com	Mar 1, 2012 9:19 AM
18	nancy@exteriorsinternational.com	Mar 1, 2012 8:28 AM
19	pbaxter@constructionlabor.com	Mar 1, 2012 7:13 AM
20	Verna Regler, Executive Director Building Congress & Exchange of Metro. Baltimore. vregler@bcebaltimore.org	Mar 1, 2012 6:07 AM
21	info@tileability.ie	Mar 1, 2012 2:31 AM
22	harald.graf-andresen@kvaerner.com	Mar 1, 2012 1:58 AM
23	Val Harrison Val@harrison.ie	Mar 1, 2012 1:27 AM
24	frank.swanberg@shorenz.co.nz	Feb 29, 2012 5:42 PM
25	Jacqui Bensemann jbensemann@argusfire.co.nz	Feb 29, 2012 3:13 PM
26	macesundar@yahoo.com	Feb 29, 2012 11:31 AM
27	I would be interested in seeing the results. ecatellier@beckermorgan.com Thanks.	Feb 29, 2012 7:20 AM

Q14. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

28	Yes I would like to receive the result of this survey. My id is sid4951@gmail.com	Feb 29, 2012 6:57 AM
29	yes bills@PMSIcorp.com	Feb 29, 2012 6:47 AM
30	cdennin@messer.com	Feb 29, 2012 5:58 AM
31	Dermot Kearns Independent Insulation Consultant 087-0526909 www.simpleinsulationsolutions.ie	Feb 29, 2012 4:29 AM
32	Yes	Feb 29, 2012 3:05 AM
33	lancealborn@gmail.com	Feb 29, 2012 1:57 AM
34	zhou.st@hotmail.com	Feb 29, 2012 1:56 AM
35	kimwingdai@gmail.com	Feb 29, 2012 12:32 AM
36	Christopher Gould President - Gould Design Inc. Email: cgould@goulddesigninc.com Website: www.goulddesigninc.com Blog: http://goulddesigninc.wordpress.com/ Twitter: GouldDesignInc	Feb 28, 2012 1:53 PM
37	kevinboyle@murphygroup.co.uk	Feb 28, 2012 12:33 AM
38	paul@konectall.com	Feb 27, 2012 4:20 AM
39	rmillar@professionaltradesmen.ie	Feb 26, 2012 9:43 AM
40	mg.carroll@hotmail.com	Feb 24, 2012 8:42 AM
41	please send me a copy of the results to eddie@senubo.com	Feb 23, 2012 4:54 AM
42	I would be interested in hearing about the results of this survey - hugh.hofmeister@ennova.com.au	Feb 22, 2012 5:29 PM

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4	Texas Construction Experts	Member Settings
5	Uk Construction Network	Member Settings
6	The Asia Construction Lounge	Member Settings
7	Carolina Contractor's Forum	Member Settings
8	CIOB (Chartered Institute Of Building)	Member Settings
9	CITA BIM Group	Member Settings
10	CITA SME EIN	Member Settings
11	Civil Construction & Engineering in Canada	Member Settings
12	COMIT Australia	Member Settings
13	COMIT PROJECTS Ltd (Construction Opportunities for Mobile IT)	Member Settings
14	Construct IN - Middle East	Member Settings
15	construction Asia	Member Settings
16	Construction Association of South Florida (CASF)	Member Settings
17	Construction in Qatar for the World Cup 2022 (Surveyor, Engineer, Contract, Planner, Project Manager	Member Settings
18	Construction in South Africa	Member Settings
19	Construction Information Services	Member Settings
20	Construction Ireland	Member Settings
21	Construction London	Member Settings
22	Construction Networking	Member Settings
23	Construction Professionals Forum	Member Settings
24	Construction Who's Who	Member Settings
25	Construction, Engineering and Property Professionals in New Zealand	Member Settings
26	Design and Construction Network	Member Settings
27	European Contract Managers	Member Settings
28	Expat Quantity Surveying, Construction and Engineering group	Member Settings
29	Georgia Construction Link	Member Settings
30	Indian Construction Industry Group	Member Settings
31	Indiana Construction Connection Network	Member Settings
32	Indiana Construction Roundtable	Member Settings
33	Irish Construction & Civil Engineering Industry Group	Member Settings
34	The Maryland Construction Network	Member Settings
35	Journal of Information Technology in Construction	Member Settings
36	Linking CONSTRUCTION	Member Settings
37	Maryland/DC Construction Professionals	Member Settings
38	Modular Construction	Member Settings
39	Nevada Construction Professionals	Member Settings

40	**New Jersey Real Estate Development and Construction**	Member Settings
41	**New Zealand Infrastructure & Construction**	Member Settings
42	**Qatar Construction and Infrastructure**	Member Settings
43	**Quantity Surveyor, Commercial Managers & Consultants for the Middle East**	Member Settings
44	**tCn - the UK CONSTRUCTION network - Official Group**	Member Settings
45	**Waterproofing Network**	Member Settings
46		
47		
48		
49		
50		

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COMIT PROJECTS Ltd (Construction Opportunities for Mobile IT)

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1 of 20   Next »

I am carrying out research for my thesis regarding the use of smartphones and tablets in the Construction Industry. If you could complete this short 2/3 minute survey it would be greatly appreciated.

Increased productivity in the construction industry using smartphones...

surveymonkey.com
For the purpose of data analyses, which of the following best describes your profession within the construction industry? Managing Director Head office support e.g. Finance, Plant, Purchasing, Planning, Human Resources etc....
1 month ago

| Like | Comment | Unfollow | Flag | More |

6 comments

Ryan Briggs • Completed the survey for you Andrew and be interested to see the results.

Interested in collaborating in any future research you may be involved with.

Ryan - ryan@woobius.com.

Follow Ryan

1 month ago • Unlike   1

Sharika Fernando • Hi Andrew, Interesting survey.....COMIT Projects Ltd has done a similar survey and the report is due out very soon.

1 month ago • Unlike   1

Follow Sharika

Andrew Doyle • Do you know when the COMIT survey results are out? And if they are available to non members? I have to submit this research at the end of next week

10 days ago

Mark Wrigley • Hi Andrew, not sure my completing your survey will help your results at all as we are suppliers rather than users. Most of your questions are directed at users, but if you think it would help still then I would be happy to. Let me know.
Regards,
Mark

Follow Mark

9 days ago • Like

Sharika Fernando • Hi Andrew,

Sorry for the delay in responding...yes the report is out......but not accessible to non-members. But guess we can talk about it!

Follow Sharika

4 days ago • Like

Andrew Doyle • Hi Sharika,

Is this report that you are referring to different to the ones that can be found here?

http://www.fiatech.org/about/news/1036-mobile-it-phase-ii-report-now-available

and

http://www.fiatech.org/about/news/1039-smart-devices-show-potential-to-help-in-real-time-field-reporting

4 days ago

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http://lnkd.in/vpFm6R

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Andrew Doyle and 1 more commented on:
I am carrying out research for my thesis regarding the use of smartphones and tablets in the Construction Industry. If you could complete this short 2/3 minute survey it would be greatly appreciated.
6 comments   4 days ago

Nigel White has joined the group.
Send message   5 days ago

Mark Wrigley commented in the group on: I am carrying out research for my thesis regarding the use of smartphones and tablets in the Construction Industry. If you could complete this short 2/3 minute survey it would be greatly appreciated.: Hi Andrew, not sure my completing your survey will help your results at all as we are suppliers rather than users. Most of your questions...
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APPENDIX C.2:

IRELAND MAIN CONTRACTOR

QUESTIONNAIRE RESULTS

Increased productivity in the construction industry using smartphones and tablet computers

SurveyMonkey

1. For the purpose of data analyses, which of the following best describes your profession within the construction industry?

		Response Percent	Response Count
Managing Director		10.7%	3
Contracts Manager		7.1%	2
Project Manager		14.3%	4
Quantity Surveyor		**25.0%**	**7**
Estimator		7.1%	2
Health and Safety Officer		0.0%	0
Architect		0.0%	0
Civil Engineer		0.0%	0
Structural Engineer		0.0%	0
Building Services Engineer		0.0%	0
Head office support e.g. Finance, Plant, Purchasing, Planning, Human Resources etc.		17.9%	5
Other		17.9%	5
	Other (please specify)		10
	answered question		**28**
	skipped question		**4**

2. Approximately what size is your company?

		Response Percent	Response Count
Small (1 - 24 employees)		3.1%	1
Medium (25 - 100 employees)		25.0%	8
Large (100 + employees)		**71.9%**	**23**
		answered question	32
		skipped question	0

3. Do you use smartphones or tablet computers as part of your job duties?

		Response Percent	Response Count
Yes		**78.1%**	**25**
No		21.9%	7
If yes, what tasks do you carry out with the smartphone/tablet computer?			24
		answered question	32
		skipped question	0

4. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

		Response Percent	Response Count
Yes		**93.5%**	**29**
No		3.2%	1
Not sure		3.2%	1
If yes, what do they use them for?			28
		answered question	31
		skipped question	1

5. Does your company have any plans to make greater use of smartphones or tablet computers?

		Response Percent	Response Count
Yes	�	**46.9%**	**15**
No	▱	15.6%	5
I don`t know	▱	37.5%	12
		Additional comments	12
		answered question	**32**
		skipped question	**0**

6. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

	Response Count
	28
answered question	**28**
skipped question	**4**

7. What is your level of agreement with the following statement? "The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers."

		Response Percent	Response Count
Strongly agree		12.9%	4
Agree		**48.4%**	**15**
Neither agree nor disagree		12.9%	4
Disagree		19.4%	6
Strongly disagree		6.5%	2
	Additional Comments		10
	answered question		**31**
	skipped question		**1**

8. If you have recently worked in the construction industry abroad, do you feel that they have embraced smartphones/tablet computers in the industry more than in Ireland?

		Response Percent	Response Count
Yes		9.7%	3
No		16.1%	5
Not applicable		**74.2%**	**23**
	Additional Comments		4
	answered question		**31**
	skipped question		**1**

9. If you have recently worked in another industry other than construction, do you feel that this industry has embraced smartphones/tablet computers more than the construction industry has?

		Response Percent	Response Count
Yes		10.0%	3
No		16.7%	5
Not applicable		**73.3%**	**22**
	Additional Comments		5
	answered question		**30**
	skipped question		**2**

10. Do you feel that time spent by engineers, construction managers etc, in the site office detracts from time that could be spent supervising/monitoring/recording works on site?

		Response Percent	Response Count
Yes		37.9%	11
No		**51.7%**	**15**
Not sure		10.3%	3
	answered question		**29**
	skipped question		**3**

11. Do you feel it would be beneficial for engineers, construction managers etc to be able to access information, capture data and communicate data whilst outside of their site offices?

		Response Percent	Response Count
Yes		93.5%	29
No		3.2%	1
Not sure		3.2%	1
	Additional Comments		7

answered question	**31**
skipped question	**1**

12. Do you feel that teaching students about the productivity benefits of smartphones and tablet computers is key to the construction industry embracing this new technology?

		Response Percent	Response Count
Yes		80.6%	25
No		9.7%	3
Not sure		9.7%	3
	Additional comments		11

answered question	**31**
skipped question	**1**

13. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

	Response Count
	13
answered question	13
skipped question	19

14. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

	Response Count
	1
answered question	1
skipped question	31

Q1. For the purpose of data analyses, which of the following best describes your profession within the construction industry?

1	Construction Director	Feb 24, 2012 7:50 AM
2	Group Productivity Manager	Feb 22, 2012 1:34 AM
3	Director	Feb 20, 2012 2:22 PM
4	Environmental Health and Safety Manager	Feb 15, 2012 6:08 AM
5	IT	Feb 14, 2012 3:22 AM
6	Managing Surveyor	Feb 13, 2012 9:25 AM
7	Head of Group IT	Feb 13, 2012 4:59 AM
8	Director	Feb 7, 2012 3:25 AM
9	Director	Feb 6, 2012 9:06 AM
10	Regional Director	Feb 6, 2012 1:45 AM

	Q3. Do you use smartphones or tablet computers as part of your job duties?	
1	email generally. Just rolled out a pilot with tablets to carry out QA inspections etc	Feb 24, 2012 7:50 AM
2	e-mail, calendar management and similar tasks	Feb 22, 2012 1:34 AM
3	Checking and responding to mail. Opening documents. Maintaining calendar and journal. Sending photographs.	Feb 21, 2012 1:14 PM
4	Communications, emails, spreadsheets, planning	Feb 20, 2012 2:22 PM
5	iphones for calls, emails, photos etc	Feb 15, 2012 6:54 AM
6	Email on smartphone	Feb 14, 2012 4:10 AM
7	E Mail Internet Some App's for picutres and dimensioning App's for Weather Forecasting	Feb 14, 2012 3:50 AM
8	work related emails,	Feb 14, 2012 3:25 AM
9	Email	Feb 14, 2012 3:24 AM
10	Email, remote desktop to servers.	Feb 14, 2012 3:22 AM
11	Currently just checking emails	Feb 13, 2012 2:55 PM
12	e-mail correspondence generally	Feb 13, 2012 9:25 AM
13	Emails / Internet at fingertips	Feb 13, 2012 7:49 AM
14	Email	Feb 13, 2012 7:25 AM
15	i phone	Feb 13, 2012 5:13 AM
16	senior management only; e-mail communication, intranet (DMS) access	Feb 13, 2012 4:59 AM
17	Phone, Calender,e mail, text.	Feb 8, 2012 4:52 AM
18	Receive emails through the smart phone	Feb 7, 2012 1:18 PM
19	Calls Email File Transfer Navigation General administration Spreadsheet development Marketing Presentation Development Drawing Review Video conferencing	Feb 7, 2012 3:25 AM
20	email diary video/camera access to files	Feb 6, 2012 1:48 PM
21	Email and photograghs only.	Feb 6, 2012 12:44 PM
22	Email, calendar for appointments & meeting invitations, taking progress photographs	Feb 6, 2012 9:06 AM
23	Email Outlook diary	Feb 6, 2012 2:58 AM
24	E-mail	Feb 6, 2012 1:45 AM

	Q4. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?	
1	Mainly Smart Phones used by Contract Directors and Contract Managers. Mainly for checking and replying to e-mails.	Mar 2, 2012 7:59 AM
2	As above	Feb 22, 2012 1:34 AM
3	Checking and responding to mail. Opening documents. Maintaining calendar and journal. Sending photographs.	Feb 21, 2012 1:14 PM
4	as above	Feb 20, 2012 2:22 PM
5	Mostly emails, internet access and very occasionally for preparing letters, spreadsheets, etc...	Feb 19, 2012 2:00 PM
6	reading emails organising meetings	Feb 16, 2012 3:05 AM
7	As above	Feb 15, 2012 6:54 AM
8	Communications time management incident investigations, evidence gathering	Feb 15, 2012 6:08 AM
9	Email	Feb 14, 2012 4:10 AM
10	E-Mail mainly	Feb 14, 2012 3:50 AM
11	access to email	Feb 14, 2012 3:25 AM
12	Email	Feb 14, 2012 3:24 AM
13	company email.	Feb 14, 2012 3:22 AM
14	Emails mainly, sometime skype for project abroad.	Feb 13, 2012 2:55 PM
15	Reviewing emails on the go.	Feb 13, 2012 9:26 AM
16	ditto as above	Feb 13, 2012 9:25 AM
17	Emails / Internet at fingertips	Feb 13, 2012 7:49 AM
18	Email. Helpdesk use them to remotely access systems.	Feb 13, 2012 7:25 AM
19	i phone and i pads	Feb 13, 2012 5:13 AM
20	As 3. above	Feb 13, 2012 4:59 AM
21	As above	Feb 8, 2012 4:52 AM
22	Emails	Feb 7, 2012 1:18 PM
23	As above	Feb 7, 2012 3:25 AM
24	email diary	Feb 6, 2012 1:48 PM
25	email & photography. maybe calculator and gps.	Feb 6, 2012 12:44 PM
26	As above, some colleagues use an app that records the telephone calls they make/take into their calendar. They use this information to improve the accuracy of his timesheets	Feb 6, 2012 9:06 AM

Q4. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

27	Email	Feb 6, 2012 2:58 AM
28	Same	Feb 6, 2012 1:45 AM

Q5. Does your company have any plans to make greater use of smartphones or tablet computers?

1	Following pilot above we will role out a wider programme to minimise the paperwork / form filing.	Feb 24, 2012 7:50 AM
2	Most senior managers in the field are on smart phones	Feb 22, 2012 1:34 AM
3	Tablets will rolled out as finances permit for tracking progress, document storage, NCR reports, etc.	Feb 21, 2012 1:14 PM
4	reduce paper as much as possible	Feb 20, 2012 2:22 PM
5	Not that I am aware of	Feb 19, 2012 2:00 PM
6	Now giving same to Project Managers and Project Surveyors	Feb 15, 2012 6:54 AM
7	for ease of communication	Feb 14, 2012 3:25 AM
8	Although present economic factors may effect this	Feb 13, 2012 9:25 AM
9	Access to SharePoint, MS Lync.	Feb 13, 2012 7:25 AM
10	Considering trialling one large site using a business application of social networking	Feb 13, 2012 4:59 AM
11	Plans to upgrade and roll out further across the company	Feb 7, 2012 3:25 AM
12	It is intended to purchase tablet computers for use during landowner liason on infrastructural projects	Feb 6, 2012 9:06 AM

Q6. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

1	E-mails E-mail replies Checking products on Google Storing Phone Numbers	Mar 2, 2012 7:59 AM
2	SIte inspections Safety inspections / audits QA documentation Snag reviews	Feb 24, 2012 7:50 AM
3	e-mail etc	Feb 22, 2012 1:34 AM
4	Mail File updates Interim valuations Meeting reports and minutes. NCR - Safety & quality.	Feb 21, 2012 1:14 PM
5	communications, planning tools, presentations, reports	Feb 20, 2012 2:22 PM
6	Reading and writing emails, completing exercises that involve microsoft office programmes (excel, word, etc...). As my profession involves using excel for many exercises, this is where I would feel it would benefit most.	Feb 19, 2012 2:00 PM
7	Dealing with requests for information while on site, issuing photos of snags as they come up etc.	Feb 15, 2012 6:54 AM
8	data gathering no for security, quality and property rights issues. Verification evidence OK Personel time management Communications management	Feb 15, 2012 6:08 AM
9	Responding to emails, reviewing documents	Feb 14, 2012 4:10 AM
10	E-Mailing Drawing Communication Video Conferencing / Calls	Feb 14, 2012 3:50 AM
11	ease of communication .. emails and access to information on the go	Feb 14, 2012 3:25 AM
12	Email	Feb 14, 2012 3:24 AM
13	Viewing drawings on tablets instead of large sheets, communication, etc.	Feb 14, 2012 3:22 AM
14	Video conferencing	Feb 13, 2012 2:55 PM
15	Receiving and sending emails. Reviewing documents including drawings on location, particuly good with tablets the zoom capability enables the close up view printed drawings sometimes dont.	Feb 13, 2012 9:26 AM
16	Personally I am apposed to the use of e-mail etc within the construction industry as it has become a tool for scatter gun management and task transference, it has also decreased the level of verbal communication between construction professionals and allows for information to be too easily circulated without consideration of the impact of doing so...	Feb 13, 2012 9:25 AM
17	Viewing Construction Drawings / GPS Uses / Send and receiving emails.	Feb 13, 2012 7:49 AM
18	Quality management. Example is software called Latista.	Feb 13, 2012 7:25 AM
19	review drawings, take photos and tranform to pdf on the go, resspond to emails etc while at meeting etc	Feb 13, 2012 5:13 AM
20	Work lists, snag lists, meeting notes, inspection reports, shared with relevant personnel	Feb 13, 2012 4:59 AM
21	As above, but could make greater use of particular software if available.	Feb 8, 2012 4:52 AM
22	Checking drawings Email site diary snag lists	Feb 7, 2012 1:18 PM

Q6. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

23	All as mentioned above	Feb 7, 2012 3:25 AM
24	reading and	Feb 6, 2012 1:48 PM
25	It's a pity we hadn't got smart phones during the boom. (I had a early Blackberry that was great for emails only.)	Feb 6, 2012 12:44 PM
26	Instead of of printing A1 size drawings for meetings, drawings / mapping / aerial photography will be available and easily magnifiable on the tablet. Smartphones are useful for photography / filming purposes when a camera isn't available.	Feb 6, 2012 9:06 AM
27	Email Diary	Feb 6, 2012 2:58 AM
28	Reports Monitoring Progress	Feb 6, 2012 1:45 AM

Q7. What is your level of agreement with the following statement?

"The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers."

1	Mainly due to no money in construction at present.	Mar 2, 2012 7:59 AM
2	Site elements most deffinitely lag behind.	Feb 24, 2012 7:50 AM
3	Construction industry is often an 'old school' management style of face to face / voice communication. The industry is also highly populated (al be it lower now due to receission) with smaller companies whom would not be interested in the smart phones.	Feb 14, 2012 3:50 AM
4	I think this is changing and over the next few years smart phones will be company wide	Feb 14, 2012 3:25 AM
5	Not in relation to smart phones, but most definately in relation to tablets.	Feb 13, 2012 9:26 AM
6	This is probably due to the fact that as an industry we are not perhaps best suited to utilise it, or indeed we have a cultural issue with the adoption of such technology	Feb 13, 2012 9:25 AM
7	mainly because of cost constraints	Feb 13, 2012 4:59 AM
8	IT yes but Smartphones or mobile tech: No	Feb 13, 2012 4:59 AM
9	The outdoor nature can restrict the use of such devices The introduction of QA and its necessity may require further investment in such devices	Feb 7, 2012 1:18 PM
10	agree to some extent, however it depends greatly on the type and size of project, also the age profile of senior management in a company has some influence, in my opinion.	Feb 6, 2012 1:48 PM

Q8. If you have recently worked in the construction industry abroad, do you feel that they have embraced smartphones/tablet computers in the industry more than in Ireland?

1	Based on UK and Mid East experience.	Feb 20, 2012 2:22 PM
2	I do not have great experiance in this area and could be presuaded otherwise by good arguement.	Feb 15, 2012 6:08 AM
3	australia and america	Feb 13, 2012 5:13 AM
4	Have no recent foreign experiance.	Feb 6, 2012 12:44 PM

Q9. If you have recently worked in another industry other than construction, do you feel that this industry has embraced smartphones/tablet computers more than the construction industry has?

1	same as 8	Feb 15, 2012 6:08 AM
2	again, I think smart phones are only on the rise.. over the next few years every industry will have a smart phone	Feb 14, 2012 3:25 AM
3	The Construction Industry is generally slow to accept new technology... tried & test methods usually prevail. But slowly over the last few years things are moving in the right direction.	Feb 13, 2012 2:55 PM
4	yes marketing	Feb 13, 2012 5:13 AM
5	In the education sector the use of smart phones is common place with tablet computers becoming more popular all the time.	Feb 7, 2012 1:18 PM

Q11. Do you feel it would be beneficial for engineers, construction managers etc to be able to access information, capture data and communicate data whilst outside of their site offices?

1	Under the right circumstance and quality control arrangements this could be achieved but shifting to a system of electronic data collection would be immediately destabilising and possiby catastrophically risky in the long term	Feb 15, 2012 6:08 AM
2	Anything that saves time and maekes the working day more efficient is better	Feb 14, 2012 3:50 AM
3	they are always up to date with emails and don't have to wait an hour to get back to their pc to look at their email	Feb 14, 2012 3:25 AM
4	Greater sharing & recording of data is essential to an efficient site.	Feb 13, 2012 2:55 PM
5	It would make the transfer of data quicker and easier.	Feb 13, 2012 9:26 AM
6	not sure, most would consider this an unsafe practice...	Feb 13, 2012 9:25 AM
7	Yes, it is beneficial, but must also be viewed in the context of work-life balance. Technology makes people available at all hours	Feb 6, 2012 9:06 AM

Q12. Do you feel that teaching students about the productivity benefits of smartphones and tablet computers is key to the construction industry embracing this new technology?

1	Students already having a better understanding of these products than Management.	Mar 2, 2012 7:59 AM
2	it will also depend on the policy of the company they re working for.	Feb 20, 2012 2:22 PM
3	Information technology in general is key to the future learning of all professionals, but this is not limited to smartphones/tablet computers.	Feb 19, 2012 2:00 PM
4	Do I think this is a good thing? Construction students should learn how to construct!	Feb 15, 2012 6:08 AM
5	definately. the efficiency of use would then be very effective compared to current requiorements of 'self thought'	Feb 14, 2012 3:50 AM
6	this applies to any industry I think	Feb 14, 2012 3:25 AM
7	Advances in technology in surveying for example over the last number of years has greatly increased productivity, all coming from graduates with the knowledge to operate the systems... advances will be made with new technology in the same way	Feb 13, 2012 2:55 PM
8	The benifits our obvious to anyone who is familure with such technologies.	Feb 13, 2012 9:26 AM
9	As long as the teaching provide creates a generation who use the technology correct and do not abuse it...	Feb 13, 2012 9:25 AM
10	Not key, but helpful.	Feb 13, 2012 4:59 AM
11	Young people / students will adopt technology easier and earlier than others. Foreign work experiance will help ie j1, Oz, NZ, etc.	Feb 6, 2012 12:44 PM

Q13. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

1	No.	Mar 2, 2012 7:59 AM
2	There has to be company policy with the use of smartphones because they cna be dangerous in the wrong hands	Feb 15, 2012 6:54 AM
3	Good luck with your studies	Feb 15, 2012 6:08 AM
4	definately a benefit and shoud be incorporated a lot more	Feb 14, 2012 3:50 AM
5	security is one aspect that might hold industries back from embracing smart phone technology	Feb 14, 2012 3:25 AM
6	By being able to receive & record large amounts of data whilst having the programs & mobility to utilise the data is essential to increasing efficiency in a very competitive market.	Feb 13, 2012 2:55 PM
7	Smartphones and tablets are very delicate technologies and are definately not designed for on site use. This is a major drawback.	Feb 13, 2012 9:26 AM
8	As per comments above I am concerned about the uses of such devices in the construction industry and the culture that is being created as a result..	Feb 13, 2012 9:25 AM
9	No	Feb 13, 2012 7:49 AM
10	They are not best suited to Irish outdoors use; quite slow to input data using one hand to hold the device. Best used in the site office on a support, out of the wind and rain! Usage will increase as prices fall and business social networking sites for construction improve.	Feb 13, 2012 4:59 AM
11	you need to differientiate between: personal productivity common collaboration tools (email etc) construction specific tools	Feb 13, 2012 4:59 AM
12	I love my Samsung Galaxy !	Feb 6, 2012 12:44 PM
13	Useful tool. Care should be taken not to abuse it by creating additional reporting activities that are ' nice to have ' but do not add any additional ' value ' to the product being delivered.	Feb 6, 2012 1:45 AM

Q14. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

1	david.hartley@walls.ie	Mar 2, 2012 7:59 AM

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APPENDIX C.3:

IRELAND SUBCONTRACTOR

QUESTIONNAIRE RESULTS

Increased productivity in the construction industry using smartphones and tablet computers

SurveyMonkey

1. For the purpose of data analyses, which of the following best describes your role within your company?

		Response Percent	Response Count
Manager		**62.5%**	**5**
Skilled Worker		0.0%	0
Quantity Surveyor		12.5%	1
Engineer		0.0%	0
Head office support e.g. Finance, Plant, Purchasing, Planning, Human Resources etc.		25.0%	2
Other		0.0%	0
	Other (please specify)		0
	answered question		8
	skipped question		0

2. Approximately what size is your company?

		Response Percent	Response Count
Small (1 - 24 employees)		**100.0%**	**8**
Medium (25 - 100 employees)		0.0%	0
Large (100 + employees)		0.0%	0
	answered question		8
	skipped question		0

3. Do you use smartphones or tablet computers as part of your job duties?

		Response Percent	Response Count
Yes		**62.5%**	**5**
No		37.5%	3
If yes, what tasks do you carry out with the smartphone/tablet computer?			5
	answered question		8
	skipped question		0

4. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

		Response Percent	Response Count
Yes		**62.5%**	**5**
No		12.5%	1
Not sure		25.0%	2
If yes, what do they use them for?			4
	answered question		8
	skipped question		0

5. Does your company have any plans to make greater use of smartphones or tablet computers?

		Response Percent	Response Count
Yes		**50.0%**	**4**
No		25.0%	2
I don`t know		25.0%	2
	Additional comments		1
	answered question		**8**
	skipped question		**0**

6. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

	Response Count
	7
answered question	**7**
skipped question	**1**

7. What is your level of agreement with the following statement? "The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers."

		Response Percent	Response Count
Strongly agree		12.5%	1
Agree		25.0%	2
Neither agree nor disagree		**50.0%**	**4**
Disagree		25.0%	2
Strongly disagree		0.0%	0
	Additional Comments		1
	answered question		**8**
	skipped question		**0**

8. If you have recently worked in the construction industry abroad, do you feel that they have embraced smartphones/tablet computers in the industry more than in Ireland?

		Response Percent	Response Count
Yes		12.5%	1
No		12.5%	1
Not applicable		**75.0%**	**6**
	Additional Comments		0
	answered question		**8**
	skipped question		**0**

9. If you have recently worked in another industry other than construction, do you feel that this industry has embraced smartphones/tablet computers more than the construction industry has?

		Response Percent	Response Count
Yes		12.5%	1
No		12.5%	1
Not applicable		**75.0%**	**6**
	Additional Comments		0
	answered question		**8**
	skipped question		**0**

10. Do you feel that time spent by engineers, construction managers etc, in the site office detracts from time that could be spent supervising/monitoring/recording works on site?

		Response Percent	Response Count
Yes		37.5%	3
No		**50.0%**	**4**
Not sure		12.5%	1
	answered question		**8**
	skipped question		**0**

11. Do you feel it would be beneficial for engineers, construction managers etc to be able to access information, capture data and communicate data whilst outside of their site offices?

		Response Percent	Response Count
Yes		**100.0%**	8
No		0.0%	0
Not sure		0.0%	0
	Additional Comments		0
	answered question		**8**
	skipped question		**0**

12. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

		Response Percent	Response Count
Ruggedness of the devices		25.0%	2
Cost of the devices		12.5%	1
Training in the use of the devices		25.0%	2
Safety issues regarding the use of the devices		0.0%	0
These barriers can be overcome		**50.0%**	4
	Other (please specify)		1
	answered question		**8**
	skipped question		**0**

13. Do you feel that teaching students about the productivity benefits of smartphones and tablet computers is key to the construction industry embracing this new technology?

		Response Percent	Response Count
Yes		**87.5%**	7
No		0.0%	0
Not sure		12.5%	1
	Additional comments		0
	answered question		**8**
	skipped question		**0**

14. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

	Response Count
	1
answered question	**1**
skipped question	**7**

15. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

	Response Count
	0
answered question	**0**
skipped question	**8**

Q3. Do you use smartphones or tablet computers as part of your job duties?

1	ga 3 scafloding inspection forms . email	Feb 13, 2012 1:04 PM
2	Internet searches for supplier and product details, Used to store and access data files, eg. Building regulations technical guidance docs. E-mail, Diary, Reminders, Photos,	Feb 13, 2012 12:49 PM
3	using a tablet to show clients samples	Feb 8, 2012 1:24 PM
4	send notes, pictures, emails back to office loging onto office server	Feb 8, 2012 4:56 AM
5	Retrieving email mostly and viewing documents	Feb 7, 2012 5:39 AM

Q4. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

1	photos / email	Feb 13, 2012 1:04 PM
2	As above	Feb 13, 2012 12:49 PM
3	same as above	Feb 8, 2012 4:56 AM
4	Email, document viewing and presentations	Feb 7, 2012 5:39 AM

Q5. Does your company have any plans to make greater use of smartphones or tablet computers?

1	The Construction Industry is in such a depressed state in Ireland and as far as this Company is concerned it may cease to trade.	Feb 13, 2012 10:18 AM

Q6. What tasks do you feel could be completed by a construction professional in the field / in transit, using smartphones and tablet computers?

1	quality control inspections and saftey inspections .	Feb 13, 2012 1:04 PM
2	As listed above	Feb 13, 2012 12:49 PM
3	No comment	Feb 13, 2012 10:18 AM
4	e.mail ,veiwing plans etc	Feb 8, 2012 1:24 PM
5	project management updating general management	Feb 8, 2012 4:56 AM
6	Creating site specific risk assessments, plans & profiles, internet connection, communications etc.	Feb 7, 2012 8:51 AM
7	Following up with colleagues and clients, staying ahead of the game and performing daily duties more efficiently. Time saving	Feb 7, 2012 5:39 AM

Q7. What is your level of agreement with the following statement?

"The construction industry lags behind other industries in the adoption of information technology, in particular smartphones and tablet computers."

1	None	Feb 13, 2012 10:18 AM

Q12. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

1	needs education of systems to emplment	Feb 13, 2012 1:04 PM

Q14. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

1	One example of the use of the smart phone is when we are shuttering a concrete stairs i uses the "DeluxStairs app" this app allows me to caluated the stairs diemention with in seconds and adjust to suit a opening size allso giveing me outher calulation to reference stairs , this cuts out alot of time .	Feb 13, 2012 1:04 PM

APPENDIX C.4:

UNITED STATES

QUESTIONNAIRE RESULTS

Increased productivity in the construction industry using smartphones and tablet computers

SurveyMonkey

1. For the purpose of data analyses, which of the following best describes your role within your company?

		Response Percent	Response Count
Director		**38.9%**	**7**
Contracts Manager		5.6%	1
Project Manager		5.6%	1
Site Manager		11.1%	2
Skilled Worker		0.0%	0
Quantity Surveyor		0.0%	0
Estimator		5.6%	1
Engineer		5.6%	1
Architect		0.0%	0
Planner		0.0%	0
Cad Technician		0.0%	0
Head office support e.g. Finance, Plant, Purchasing, Planning, Human Resources etc.		11.1%	2
Other		16.7%	3
	Other (please specify)		7
	answered question		**18**
	skipped question		**4**

2. Do you use smartphones or tablet computers as part of your job duties?

		Response Percent	Response Count
Yes		**86.4%**	**19**
No		13.6%	3

If yes, what tasks do you carry out with the smartphone/tablet computer?	18

answered question	22
skipped question	0

3. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

		Response Percent	Response Count
Yes		**95.2%**	**20**
No		0.0%	0
Not sure		4.8%	1

If yes, what do they use them for?	15

answered question	21
skipped question	1

4. Does your company have any plans to make greater use of smartphones or tablet computers?

		Response Percent	Response Count
Yes		**72.7%**	**16**
No		13.6%	3
I don`t know		13.6%	3
	Additional comments		8
	answered question		22
	skipped question		0

5. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

		Response Percent	Response Count
Smartphones/Tablets prone to damage		42.1%	8
Cost of the devices		31.6%	6
Training in the use of the devices		31.6%	6
Safety issues regarding the use of the devices		10.5%	2
These barriers can be overcome		**52.6%**	**10**
	Other (please specify)		5
	answered question		19
	skipped question		3

6. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

	Response Count
	8
answered question	8
skipped question	14

7. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

	Response Count
	3
answered question	3
skipped question	19

Q1. For the purpose of data analyses, which of the following best describes your role within your company?

1	Director of Marketing	Feb 22, 2012 7:16 AM
2	Vice President Estimating and Procurement	Feb 21, 2012 11:48 AM
3	Marketing	Feb 21, 2012 10:29 AM
4	Business Development	Feb 21, 2012 10:22 AM
5	construction manager	Feb 17, 2012 2:26 PM
6	Vice President - Construction	Feb 16, 2012 3:03 PM
7	Business Development	Feb 13, 2012 10:52 AM

Q1. For the purpose of data analyses, which of the following best describes your role within your company?

	Q2. Do you use smartphones or tablet computers as part of your job duties?	
1	Use for day-to-day communication, viewing project bidding invitees, viewing webcams on project sites, taking and sharing photos of projects, viewing vendor and subcontractor websites.	Feb 21, 2012 11:48 AM
2	Smartphone: - Emails, Calendar, Contacts - Reference Documents - Quick look at drawings - Simple Spreadsheets	Feb 21, 2012 11:08 AM
3	Email, task list, calendar functions	Feb 21, 2012 10:39 AM
4	Checking emails away from work.	Feb 21, 2012 10:29 AM
5	e-mail, forward (distribute) documents, access electronic files	Feb 21, 2012 10:25 AM
6	I phone for daily useage- emails, text, etc	Feb 21, 2012 10:22 AM
7	Use of iPad for email, review of drawings (PDF) in office- allows me to have all engineering drawings categorised and integrated on both PC and tablet using dropbox- with annotations done on iPad as necessary, note taking in meetings, integrated calendar, write-up of online reports and completion of electronic online databases. In future plan to take iPad onsite to review drawings real-time etc.	Feb 19, 2012 2:52 PM
8	Email	Feb 17, 2012 2:45 PM
9	tracking productivities against estimate	Feb 17, 2012 2:26 PM
10	email, internet, file viewing	Feb 16, 2012 3:03 PM
11	Notes and inspections. I also have the drawings and specs on the tablet along with the reports by my team.	Feb 15, 2012 5:07 AM
12	Email, document review, punchlist creation, accessing contracts, contracts documents, phone calls, task lists.	Feb 13, 2012 12:41 PM
13	Email, tasks, calendar	Feb 13, 2012 11:07 AM
14	email, phone, text, social media marketing and communications.	Feb 13, 2012 10:52 AM
15	e mail, notes, reading reports, GPS	Feb 13, 2012 8:41 AM
16	Emails	Feb 13, 2012 7:03 AM
17	Email on my smart phone	Feb 10, 2012 9:19 PM
18	Checking concrete samples and drying rates, status of projects around the globe	Feb 9, 2012 1:35 PM

Q3.	Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?	
1	Tracking field labor.	Feb 21, 2012 4:20 PM
2	same as above	Feb 21, 2012 11:48 AM
3	Smartphones. Same response as above.	Feb 21, 2012 11:08 AM
4	Utilizing documents during meetings, email, and internet.	Feb 21, 2012 10:29 AM
5	same	Feb 21, 2012 10:25 AM
6	Tablets in the field to facilitate the flow of information, BIM, QA/QC.	Feb 21, 2012 10:22 AM
7	Several others that I know of (6/7) out of approx 300+ office based construction staff on the project- used for note taking, email etc. as above.	Feb 19, 2012 2:52 PM
8	Email, Phone Service	Feb 17, 2012 2:45 PM
9	same as above	Feb 17, 2012 2:26 PM
10	same	Feb 16, 2012 3:03 PM
11	Same as above, company wide	Feb 15, 2012 5:07 AM
12	Similar to above answer.	Feb 13, 2012 12:41 PM
13	Same, some tablets used for presentations to small groups.	Feb 13, 2012 10:52 AM
14	same as above	Feb 13, 2012 8:41 AM
15	Subs us I pad to email and review sibmittals in the field	Feb 10, 2012 9:19 PM

Q4. Does your company have any plans to make greater use of smartphones or tablet computers?

1	Use for reporting of field time for payroll.	Feb 21, 2012 4:20 PM
2	When the time is right! Waiting for integration into our internal computer systems and some more impressive apps to evolve.	Feb 21, 2012 11:08 AM
3	Currently attempting to procure iPads for team of Field Engineers to use on site in day to day duties and in office as a replacement for desktop PCs.	Feb 19, 2012 2:52 PM
4	the phones/tablets can only do so much. It all begins with the individual doing the input.	Feb 17, 2012 2:26 PM
5	We will continue to develop more use for the tablets to get the work out to the workplace.	Feb 15, 2012 5:07 AM
6	Plan to buy a tablet	Feb 13, 2012 11:07 AM
7	not that i am aware of.	Feb 13, 2012 8:41 AM
8	Starting to implement I pads	Feb 10, 2012 9:19 PM

Q5. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

1	No Barriers. Just implementing on jobsites as project needs require.	Feb 21, 2012 10:22 AM
2	Apps/Technology specific to industry	Feb 19, 2012 2:52 PM
3	The personnel inputting the numbers have to have a clear understanding of what they are looking at	Feb 17, 2012 2:26 PM
4	Apple vs. Android vs. Windows - no clear leader has emerged	Feb 13, 2012 11:07 AM
5	Company is slow to adopt new technolgy	Feb 13, 2012 10:52 AM

Q6. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

1	Wave of the future.	Feb 21, 2012 4:20 PM
2	There are alot of potential opportunities to utilize this technology, however, the availability of construction applications is limited.	Feb 21, 2012 10:39 AM
3	Augmented reality using 4-D modelling combined with GPS has huge potential for showing planned versus actual works completed, location of buried services etc.	Feb 19, 2012 2:52 PM
4	There are an asset if reported correctly. If not reported correctley they cause a lot of wasted time overreacting to incorrect input and the process backfires.	Feb 17, 2012 2:26 PM
5	There's a significant cost to keeping up with technology, but there's an even more significant cost if you allow your group to fall too far behind.	Feb 16, 2012 3:03 PM
6	This is a rapidly changing area for construction, with mobility of data significant for increasing productivity. The power of devices making them better able to handle large files, including 3D models will significantly help accelerate these advances.	Feb 13, 2012 12:41 PM
7	Smart phone use is already widespread, tablets will be in 1-2 years.	Feb 13, 2012 11:07 AM
8	My opinion is that the tuse of tablets can greatly increase the effectiveness and efficiency of an employee, and therefore a company.	Feb 13, 2012 10:52 AM

Q7. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

1	ron@alberici.com	Feb 21, 2012 11:48 AM
2	Michael.Curtin@pcg.com	Feb 21, 2012 11:08 AM
3	I would be very interested in receiving results of survey to date and completed results as well, if possible please- kristbradley@gmail.com. Also, these are my own views on the current and future use of tablets in construction, and not those of any company etc. Thanks, Kris.	Feb 19, 2012 2:52 PM

APPENDIX C.5:

UNITED KINGDOM

QUESTIONNAIRE RESULTS

Increased productivity in the construction industry using smartphones and tablet computers

SurveyMonkey

1. For the purpose of data analyses, which of the following best describes your role within your company?

		Response Percent	Response Count
Director		11.1%	1
Contracts Manager		**22.2%**	**2**
Project Manager		11.1%	1
Site Manager		11.1%	1
Skilled Worker		0.0%	0
Quantity Surveyor		0.0%	0
Estimator		0.0%	0
Engineer		0.0%	0
Architect		0.0%	0
Planner		0.0%	0
Cad Technician		0.0%	0
Head office support e.g. Finance, Plant, Purchasing, Planning, Human Resources etc.		**22.2%**	**2**
Other		**22.2%**	**2**
	Other (please specify)		2
	answered question		**9**
	skipped question		**0**

2. Do you use smartphones or tablet computers as part of your job duties?

		Response Percent	Response Count
Yes		**62.5%**	**5**
No		37.5%	3

If yes, what tasks do you carry out with the smartphone/tablet computer?	5

answered question	**8**
skipped question	**1**

3. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

		Response Percent	Response Count
Yes		**88.9%**	**8**
No		0.0%	0
Not sure		11.1%	1

If yes, what do they use them for?	8

answered question	**9**
skipped question	**0**

4. Does your company have any plans to make greater use of smartphones or tablet computers?

		Response Percent	Response Count
Yes		**55.6%**	**5**
No		22.2%	2
I don`t know		22.2%	2
	Additional comments		1
	answered question		**9**
	skipped question		**0**

5. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

		Response Percent	Response Count
Smartphones/Tablets prone to damage		50.0%	4
Cost of the devices		**75.0%**	**6**
Training in the use of the devices		25.0%	2
Safety issues regarding the use of the devices		37.5%	3
These barriers can be overcome		25.0%	2
	Other (please specify)		2
	answered question		**8**
	skipped question		**1**

6. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

	Response Count
	3
answered question	3
skipped question	6

7. Should you wish to receive the results of this survey, or if you have any other information that may be useful to me, please leave your contact details below; or contact me at andrew.doyle6@student.dit.ie ... thanks for your participation!

	Response Count
	0
answered question	0
skipped question	9

Q1. For the purpose of data analyses, which of the following best describes your role within your company?

| 1 | Marketing Manager | Feb 14, 2012 6:27 AM |
| 2 | Head of department - national role | Feb 14, 2012 2:24 AM |

Q2. Do you use smartphones or tablet computers as part of your job duties?

1	All electronic messaging (email, text, web-based communications, document preparation, reports)	Mar 2, 2012 11:03 AM
2	Various depends on the situation	Feb 21, 2012 9:40 AM
3	Communications and presentations.	Feb 16, 2012 11:40 AM
4	Read emails	Feb 14, 2012 6:27 AM
5	e-mail	Feb 14, 2012 2:50 AM

Q3. Do any of your colleagues in the construction industry use smartphones or tablets for their job duties?

1	All electronic messaging (email, text, web-based communications, document preparation, reports)	Mar 2, 2012 11:03 AM
2	As above	Feb 21, 2012 9:40 AM
3	Business, Contacts, Meetings	Feb 21, 2012 9:16 AM
4	The same but fewer presentations	Feb 16, 2012 11:40 AM
5	ipad for product presentations, video, photos. Smartphone for email.	Feb 14, 2012 6:27 AM
6	e-mail	Feb 14, 2012 2:50 AM
7	Progress reporting Snagging	Feb 14, 2012 2:24 AM
8	email contact	Feb 14, 2012 1:06 AM

Q4. Does your company have any plans to make greater use of smartphones or tablet computers?

| 1 | More use of tablets (currently less than 5% of management are using them) | Mar 2, 2012 11:03 AM |

Q5. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

| 1 | Data security | Mar 2, 2012 11:03 AM |

Q5. Which of the following do you feel are barriers to the adoption of smartphones/tablets in the construction industry? (you can choose more than one answer)

2	Apple compatability with Windows office software	Feb 14, 2012 6:27 AM

Q6. Have you any other comments to make regarding the use of smartphones and tablet computers in the construction industry?

1	They require clients to use more if industry is going to use more. Public sector clients use smart phones sparingly and tablet computers are discouraged.	Mar 2, 2012 11:03 AM
2	Useful tools	Feb 16, 2012 11:40 AM
3	Development of software integrated with our reporting procedures is critical issue regarding future success	Feb 14, 2012 2:24 AM

APPENDIX C.6:

PAUL OZINGA

QUESTIONNAIRE

1. Do you agree with the following statement?

The construction industry lags behind other industries in the adoption of information technology

◉ Yes

◯ No

Additional Comments

2. What tasks does your company carry out using smartphones or tablet computers?

The article in ENR.com stated that you provide quotations to clients, plan concrete pours, sign off on transactions, and track mixing trucks...what software tools do you use to carry out these tasks?

Is there any other tasks that you company carrys out using smartphones/tablets?

We use the Citrix application to run our programs through it. Some other obvious tools are communication (e-mails, texting, facetime) Viewing reports.

3. What do you feel are the main benefits of the use of smartphones and tablet computers in the construction industry?

The main benefit of using these tools starts with the old quote "time is money". The ability to gather, populate, inform and stay informed at anytime anywhere is a huge boost in employee productivity.

4. What do you feel are the main drawbacks, if any, to the use of smartphones and tablet computers in the construction industry?

Some of the main drawbacks are:
Information Security
Network reliability
Mobile internet speed
Lack of employee training and understanding. The product is only as good as the user, some users are stuck in their ways.

5. Does your company have plans to make greater use of smartphones/tablets in the future?

Our company has many plans to make greater use of smartphones/tablets. As the products evolve so do our ideas and capabilities. We are working towards reducing printing by presenting electronically etc... building our own in house apps.

6. Does your company make use of cloud computing? If so, using what service? Is it user - friendly?

7. Are you aware of the use of smartphones/tablets by other companies in the construction industry?

If yes, could you provide further details; i.e. What type of company, what they use the technology for, details of the company (contact details so I could involve them in my research would be great)

8. Have you any other comments to make regarding smartphones/tablets in the construction industry?

As a newer generation ushers in to the construction industry I believe we will see technology move faster.

I am carrying out a online survey regarding the use of smartphones/tablets in construction, if you could share this survey with any contacts you have in the construction industry it would be a great help.

The survey can be found at: https://www.surveymonkey.com/s/LG5N3TD

This survey is fully confidential and individual respondents are not tracked.

9. Would you like to receive the results of this survey?

Yes

APPENDIX C.7:

JULIAN CLAYTON

QUESTIONNAIRE

Questionnaire - Julian Clayton

SurveyMonkey

1. Do you agree with the following statement? The construction industry lags behind other industries in the adoption of information technology

		Response Percent	Response Count
Yes		**100.0%**	**1**
No		0.0%	0
	Additional Comments		1
	answered question		**1**
	skipped question		**0**

2. What tasks does your company carry out using smartphones or tablet computers? Using what software tools and / or applications?

	Response Count
	1
answered question	**1**
skipped question	**0**

3. What do you feel are the main benefits of the use of smartphones and tablet computers in the construction industry?

	Response Count
	1
answered question	**1**
skipped question	**0**

4. What do you feel are the main drawbacks, if any, to the use of smartphones and tablet computers in the construction industry?

	Response Count
	1
answered question	**1**
skipped question	**0**

5. Does your company have plans to make greater use of smartphones/tablets in the future?

	Response Count
	1
answered question	**1**
skipped question	**0**

6. Does your company make use of cloud computing? If so, using what service? Is it user - friendly?

	Response Count
	1
answered question	**1**
skipped question	**0**

7. Are you aware of the use of smartphones/tablets by other companies in the construction industry? If yes, could you provide further details; i.e. What type of company, what they use the technology for, details of the company (contact details so I could involve them in my research would be great)

	Response Count
	1
answered question	1
skipped question	0

8. Have you any other comments to make regarding smartphones/tablets in the construction industry?

	Response Count
	1
answered question	1
skipped question	0

9. Would you like to receive the results of this survey?

	Response Count
	1
answered question	1
skipped question	0

Q1. Do you agree with the following statement?

The construction industry lags behind other industries in the adoption of information technology

| 1 | The main reason behind this problem is that with any similar trade, success comes with experience. It takes a lot of experience to become successful in the construction industry and once you have gotten to that point without a tool, it's very difficult to find a reason to change. The construction industry problem is two fold in that the experienced elders generally don't want to adopt the technology, and those that do don't have the experience to use it properly. Once the experience retires, those that remain will cause a separate issue by not having the knowledge to achieve the proper quality. | Feb 28, 2012 9:18 AM |

Q2. What tasks does your company carry out using smartphones or tablet computers? Using what software tools and / or applications?

| 1 | All scheduling, punchlisting, expense tracking, documentation distribution, and reporting are completed via mobile devices. | Feb 28, 2012 9:18 AM |

Q3. What do you feel are the main benefits of the use of smartphones and tablet computers in the construction industry?

| 1 | Speed, better accuracy, and less paper. | Feb 28, 2012 9:18 AM |

Q4. What do you feel are the main drawbacks, if any, to the use of smartphones and tablet computers in the construction industry?

| 1 | Expense and training. However, a careful study of expenses should show a savings before adopting any new process or equipment. Training issues can also be offset to a certain degree by simply relaxing restrictions on equipment to allow employees a bit more freedom to utilize the devices in their personal lives. | Feb 28, 2012 9:18 AM |

Q5. Does your company have plans to make greater use of smartphones/tablets in the future?

| 1 | We are constantly developing new applications and have no intention of slowing this process. | Feb 28, 2012 9:18 AM |

Q6. Does your company make use of cloud computing? If so, using what service? Is it user - friendly?

| 1 | Yes, we utilize several options. Your question about user-friendliness is a bit | Feb 28, 2012 9:18 AM |

Q6. Does your company make use of cloud computing? If so, using what service? Is it user - friendly?

vague. In this day and age, systems that don't work as expected are ignored
by most power users.

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Q7. Are you aware of the use of smartphones/tablets by other companies in the construction industry?

If yes, could you provide further details; i.e. What type of company, what they use the technology for, details of the company (contact details so I could involve them in my research would be great)

1	I cannot comment on other companies.	Feb 28, 2012 9:18 AM

Q8. Have you any other comments to make regarding smartphones/tablets in the construction industry?

1	No.	Feb 28, 2012 9:18 AM

Q9. Would you like to receive the results of this survey?

1	No.	Feb 28, 2012 9:18 AM