# Panorama of mobile device applications (Apps) for the construction industry

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## Abstract

**Purpose** – This study was conducted to identify, summarise, analyse and categorise mobile device applications (Apps), relevant to the construction industry and to explore their uses and exposure levels.

**Design/methodology/approach** – The research method involved reviewing literature and searching for Apps. The construction Apps were found by developing key phrases. These key phrases were used to develop search strategies, which were then used to find the construction Apps. The Apps found were categorised based on the similarity of their uses.

**Findings** – The 136 Apps identified were summarised, analysed, and categorised into 11 groups of distinct construction operations and tasks. The "Design and Drawing Apps", "Measurement and Estimation Apps", "Management Apps", "All Round Apps" and "Construction Site Apps" recorded 29, 28, 26, 21 and 11 numbers of Apps, respectively. The Autodesk Sketchbook, GPS Field Area Measure, MagicPlan, Measure and TSheets were the top five in terms of the number of downloads. These Apps in terms of their exposure levels in the construction industry record 4.76%, 2.38%, 0.52%, 0.48% and 0.42%, respectively.

**Originality/value** – This paper provides a catalogue of the continuum of construction Apps for a wide variety of construction operations/activities which are available for construction professionals and provide guidance on their uses to assist in selecting appropriate Apps for specified operation/tasks/activities in the construction industry. Construction professionals may benefit from increased productivity, efficiency and ease of working.

**Keywords** Construction, Construction apps, Mobile device, Smart phone, Construction professionals

**Paper type** Literature review

## 1. Introduction

One significant feature of technological advancement in the world today is applications (Apps) which are complementary to smart mobile devices such as smart phones. These Apps have become an integral part of and is playing an indispensable role of the personal and work life of most people. The utilisation of these devices and their accompanying Apps have made

life and work easier, more productive and efficient for most people, organisations and industries. Islam *et al.* (2010) therefore noted that over the years, smart mobile devices and applications have become a rapidly growing sector in the world.

According to Regas (2002), mobile devices are electronic devices that can be used to store, access, create and modify data and information anywhere and anytime. Apps on the other hand, according to Islam *et al.* (2010), are the software that runs on a smart mobile device and executes certain tasks or works for the user. Kukulska-Hulme and Traxler (2005) cites the most common examples of smart mobile devices as smart phones and tablets. The massive use of phones and tablet that often runs on mostly android or iOS operating systems and also windows phones have made the Apps very common and readily accessible by many for numerous of tasks and operations. This has given rise to the developments of a wide variety of Apps for executing almost every task in the world.

Today, Apps have been developed to meet the work requirements of most industries such as the manufacturing and services industry. The construction industry, despite its characteristics as labour intensive, complex and multidimensional (Chan and Liu, 2007), there exist numerous Apps created for construction professionals to enable them performs their tasks effectively and efficiently. Bedard (2014) and Cline and Davis (2013), noted that such construction Apps are useful for the execution of various construction tasks by construction professionals. The continuum of construction and related Apps that exist can be used for a variety of tasks such as the measurement of construction works, setting out operations and the development and production of architectural and structural drawings. Other construction and related tasks that Apps can perform are bidding, estimation and cost calculations of works and general project management of the construction project as well as communication among construction professionals. It is imperative that these Apps have the potential to provide assistance to construction professionals in the execution of works from all three phases of construction operations: planning, designing and building (Bedard, 2014). It is therefore not surprising that Yankah and Owiredu (2016) opined that the utilisation of these Apps has the potential to increase productivity and efficiency in the execution of construction operations.

This notwithstanding, the construction professionals in the construction industry has been slow in adopting and integrating the utilisation of smart mobile Apps into their operations when compared to other sectors of the economy (Klinc *et al.*, 2010; Shen *et al.*, 2010). This is surprising because most construction professionals own and use a smart mobile device which has all the requirements to enable one to aid the use of Apps. Even in the United States of America (USA) and other developed countries where the benefits of integrating and utilising construction related apps in the work operations are well understood, professionals still look to the younger generation or upcoming construction professionals to lead in the adoption and usage of these apps (Cline and Davis, 2013).

This brings to fore the subtle impact of low exposure of construction professionals to the continuum of such Apps for construction operations. The low utilisation of smart mobile device Apps in construction appears to have been influenced by construction education and training which makes most construction professionals prefer the use of manual processes in executing the operations, tasks or activities (Nourbakhsh *et al.*, 2012). Another reason contributing to the low utilisation of construction Apps is the low level of awareness of the existence of these Apps. This is not surprising because literature on subject, according to Yankah and Owiredu (2016) is scant. There exists paucity of research on the awareness and exposure of these Apps in construction. Currently there is no study that seeks to catalogue construction Apps and maps them to various task of construction to enable construction professional to select from the Apps when needed. This suggests that construction

professionals are being educated without exposure to these emerging trends of the Apps in performing their tasks.

Against this background, the aim of this study is to identify, summarise, categorise and analyse various construction and related applications. It then examines their uses and maps them to construction operations and activities. It further explores the exposure or awareness levels of various construction Apps. This analytic paper through the selection of some smart mobile device Apps and their download numbers analyses the level of exposure of construction professionals to Apps in the construction industry. The study therefore adds to the existing knowledge of construction Apps available for construction professionals in the construction industry.

The rest of the paper first presents the method used for the study. This is followed by the findings of the study, after which discussions of the findings are made.

## 2. Research method

This study on smart mobile device applications in construction was conducted through literature search into construction applications and a subsequent processing and analysis of the Apps found. The research design was divided into three phases. The three-phase process involved familiarisation with the study topic, extant literature searches for construction Apps, and analysis and categorisation of the identified Apps.

The first phase consisted of gaining knowledge about the study topic and using the knowledge to develop key phrases to aid in the literature search of construction related Apps. Knowledge about the study topic was gained by studying and reading materials on the study topic, "smart mobile device applications in construction". Reading materials such as books, academic papers and weblogs were searched extensively. Unfortunately, no books were found relating to the study topic. However, the search for academic papers and weblogs yielded positive results. The academic papers resulting from the search were sorted out by reading and examining their titles and abstracts in order to establish a relationship between the study topic and the papers. In addition, the resulting weblogs as done for the academic papers were sorted out by examining their titles and skimming through their contents. This initial reading about the broad topic enabled the researchers to familiarise themselves with the study topic. This led to the identification of possible of certain key phrases which were used to develop search strategies prior to conducting the literature search. The search strategies used are outlined in Figure 1 as follows:

The literature searches conducted in the phase two of this study consisted of using the key phrases developed in phase one to create search strategies in order to find various smart device Apps that can be used in construction. These key phrases included "smart mobile
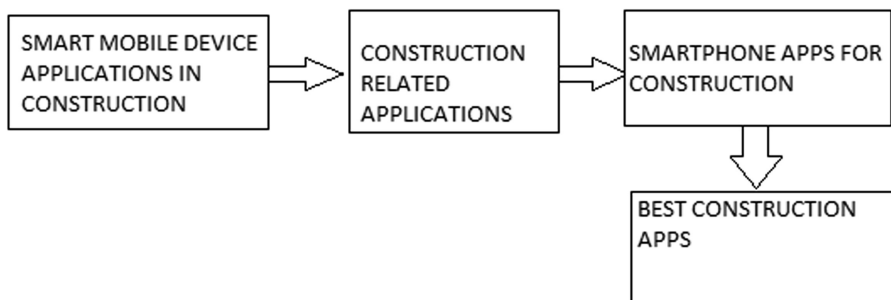


Figure 1.
Key phrases developed
in Phase one

device applications in construction", "construction related applications", "smartphone apps for construction" and "best construction apps".

The objective for developing and using these search strategies was to sieve out a vast number of academic papers and weblogs containing smart mobile device applications. For the search of these papers and weblogs, various databases were used for the literature search. These databases are academia.edu, researchgate.com, pdfdrive.com, scholar.google.com and google.com. These databases were selected because they were good sources of research papers, books and blogs relating to most topics. In addition, such sources yielded some positive results when they were searched.

Each search strategy was developed from one of the key phrases developed in phase one. Therefore, there were four search strategies. The search strategies consisted of key phrases, which were used, in conjunction with some selected construction professions and the operational platforms of smart mobile devices (i.e. Android and iOS). Construction professions were combined with the descriptive words because the applications being searched for were construction related. The operational platforms being Android and iOS were selected because they are the two most popular mobile platforms in the world. These combinations were done to deepen the search of the construction related applications. Table 1 shows how the various search strategies were developed towards the literature search of the applications.

The construction related Apps found were sorted out using their names and duplicate Apps as well as Apps that have been brought offline found in the papers and weblogs were eliminated. In addition, Apps found which could not run on smart mobile devices such as phones and tablets were eliminated.

The phase three involved the analysis and categorisation of the found applications. All the applications were studied thoroughly. Their uses, smart mobile operational platforms and their number of downloads were derived at this phase. The number of downloads of the Apps in this study are estimated figures since the sources (Google Play and Sensor Tower) prefer to keep these statistics private and only accessible to the application developers. The categorisation of the applications started by assigning the Apps, various descriptive words; so, each App had a unique descriptive word. The descriptive words were based on the construction professions that were most likely to use a particular application.

In total, eight descriptive words were assigned to the Apps as follows: "Apps for Contractors or Project Managers", "Apps for Architects", "Apps for Civil Engineers", "App

| Search strategy | Key phrases used | Key phrases combinations |
|---|---|---|
| 1 | Smart mobile device applications in construction | "Smart mobile device Apps in architecture", "smart mobile device Apps in project management or construction management", smart mobile device Apps in civil engineering" and smart mobile device Apps in surveying" |
| 2 | Construction related applications | "Construction related Apps for project management or construction management", "Construction related Apps for surveying and construction related Apps for drawing and designing" |
| 3 | Smartphone Apps for construction | "Smartphone apps for contractors", "smartphone apps for civil engineers", "smartphone apps for surveyors", "smartphone apps for architects" and "smartphone apps for artisans" |
| 4 | Best construction Apps | "Best construction apps for android users" and "Best construction apps for iOS users" |

for Quantity Surveyors", "Apps for Land Surveyors", "Apps for Carpenters", "Apps for Masons" and "Apps for Steelworkers" were the descriptive words assigned to the applications. The descriptive words were gathered into 11 categories. Four of these categories were based on the broad usage of the various applications in relation to the construction professions (descriptive words). These four categories were Management Apps, Design and Drawing Apps, Construction Site Apps, and Measurement and Estimation Apps. The other seven categories were based on the relationships between the four categories mentioned above. These categories were: "Measurement, estimation and construction site Apps", "Measurement and Drawing Apps", "Design, Drawing and Management Apps", "Management and Construction Site Apps", "Measurement and Management Apps", "Drawings and Construction Site Apps" and "All-rounder Apps".

The categories were represented in the form of a Venn diagram as illustrated in Figure 2 below.

The various categories were assigned numbers to make the identification easier. The numbers and their corresponding categories are explained in Table 2.

## 3. Results
A total number of 175 smart mobile device applications used in construction were found in the databases stated for the search. These applications were then filtered by removing all duplicate applications cited in the found papers and weblogs. After working on the filtration process, 39 duplicates were discarded. As a result, 136 construction-related Apps remained.

The most useful database used for the search was obtained from google.com. This was attributed to the fact that most of the papers and weblogs having information on construction related applications were from the google.com. In total, 76 construction related applications were yielded from the search from Google.com. Meanwhile, 18 construction related applications yielded from the Google Scholar database. Again, 23 construction related applications were yielded from Academia.edu. Also, 19 construction related applications yielded from Researchgate.com. Surprisingly, no construction related Apps were found using
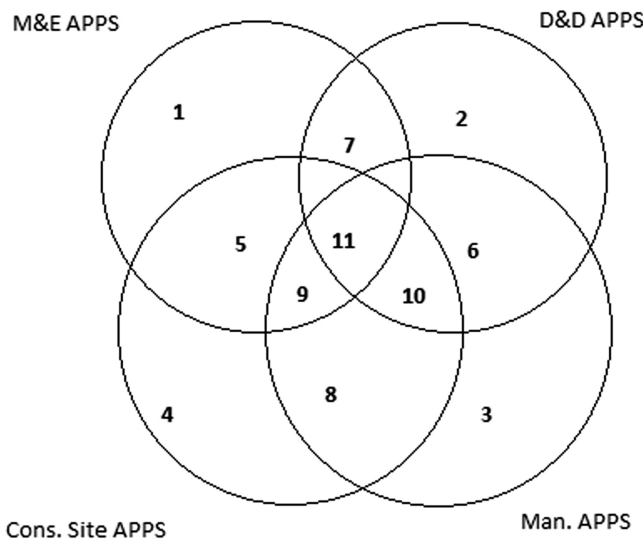


Figure 2.
Venn diagram
representing the
derived categories for
the construction Apps

| No | Category | Applications |
|---|---|---|
| 1 | Measurement and estimation apps | Simple GPS Survey, Land Calculator, Geo Measure Area Calculator, QS Toolbox, My QS, MagicPlan, Measure, Smart Ruler, Joist, JobFLEX, ARuler, Construction Estimator, Leveler, Roofing Calculator, An Estimate All Pro, Painting Estimator, Materials Estimator Calculator, Bluebeam Revu, Home Builder Pro Calcs, My Measures & Dimensions, Drywall Calculator Pro, Contract Maker Elite, Quick Service Estimate, Invoice Maker, Project Estimate Mobile, Land Calculator, Land Surveyor, Project Estimator Mobile and Contract Maker Pro |
| 2 | Design and drawing apps | GoBIM, FingerCAD, Sketchbook, Graphisoft BIMx, AutoCAD 360, Morpholio Trace, Concepts, iRhino3D, Engineering Codes and Standards. Beamdesign, Framedesign, AndTruss2D, Concrete Mix Design, Civil Engineering Pack, Civil Sutra, EpicFEM, ISOLIDMECH, Steel beam Design Calculator, Metal Weight Calculator, Bend Allowance Calculator, AutoCAD WS, AndCAD, DAKO PRO Civil Engineering, Tracing Paper Lite, Autodesk Sketchbook Pro, CAD Touch, Revit Keys, Drawvis, Autodesk FormIt 360 |
| 3 | Management apps | PlanGrid, Fieldwire, Procore, SmartBid for Construction, Autodesk BIM 360, ArchiSnapper, Bridgit Crossout, Aconex Mobile, Fieldlens, Site Boss, BuilderTREND, iConfirm, Prontoforms, Pulser-Field Construction and Punchlist, Onsite Planroom, Tradies App, Autodesk BIM 360 Field, TSheets, Archi Report, Onsite Punchlist, Construction Manager, Wrike, Project Plan 365, Project Planning Pro, Contractor Foreman and CoConstruct |
| 4 | Construction site apps | Construction Calculator, Sun Seeker, Carpenter's Helper Lite, iHandy Carpenter, iHandy Level, Safety Meeting App, Spirit Level, Crane Operator Hand Signals, eWeather HD, Heat Index App and Decibel Ultra Pro |
| 5 | Measurement, estimation and construction site apps | GPS Field Area Measure, Map Pad GPS Land Survey Measurement, Planimeter and Solocator |
| 6 | Drawing, design and management apps | Concrete Design, TurboViewer |
| 7 | Measurement, estimation and drawing apps | Scala Architectural Scale, CamToPlan, RoomScan and Rilievo |
| 8 | Management and construction site apps | iNeoSyte, Tooltracker, Hubstaff, Aconex Field, Site Diary and Timeero |
| 9 | Measurement and management apps | Building Calculator, GoCanvas and Concrete Calculator |
| 10 | Drawing and construction site apps | Steel Profiles, Steel Shapes for Metal Fabrication and Construction |
| 11 | All round apps | All-in-One Calculator, Engineering Unit Converter, Carpenter's Calculator, Red Cross First Aid, Fall Safety Pro, Handyman Calculator, Batiscript Lite, Evernote, Construction Master Pro, Google Photos, Microsoft Office, Broadcaster, Toodledo, OHSA Heat and Safety Tool, Dropbox, Good Reader, WhatsApp, iBlueprint, Safety App, Google Keep and DEWALT Mobile Pro |

**Table 2.**
Categories of the construction related applications

the Pdfdrive.com. Figure 3 presents the analysis of the percentage of Apps found using each database.

Figure 4 also shows the percentage of Apps found using the various search strategies. The second search strategy (construction related applications), yielded the highest search results

with a total 55 Apps. The first search strategy (Smart mobile device applications in construction) yielded 36 Apps. The third search strategy (Smartphone apps for construction) yielded 20 Apps and the fourth search strategy (best construction applications) yielded 25 Apps.

More than half of the smart mobile device Apps in construction found in this study can be obtained or downloaded and used on both Android and iOS platforms. A total of 71 Apps falls under this category. The study yielded 27 Apps on the iOS platform only. The study further yielded 38 Apps on the Android platform only. Figure 5 is a diagram showing the percentage of Apps per the platform.

The category with the highest number of Apps was the "Measurement and Estimation apps". This category recorded a total number of 29 Apps. The "design and drawing apps" category recorded 28 Apps and the "Management apps" category recorded 26 Apps.
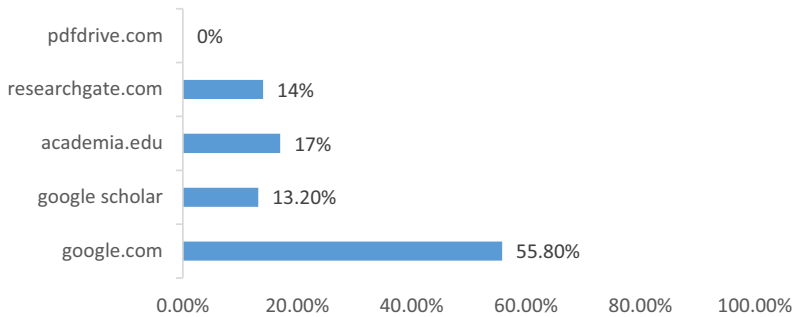


**Figure 3.**
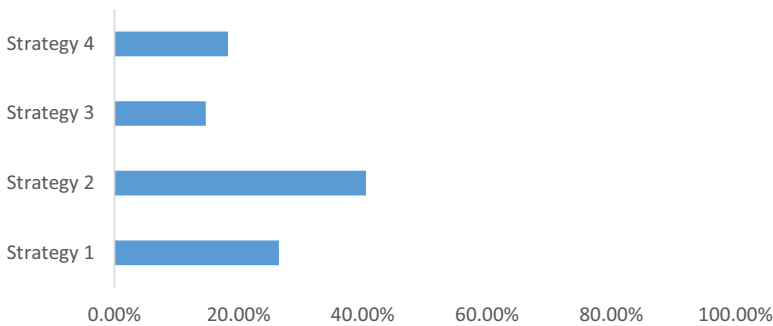Applications found per database



**Figure 4.**
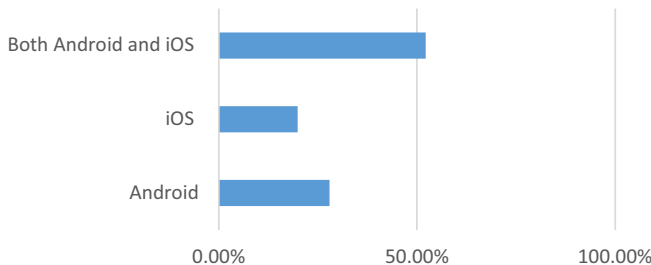Applications per each search strategy



**Figure 5.**
Applications per platform

The categories that recorded the least numbers of Apps were the "Drawing, Design and Management Apps" and the "Drawing and Construction Site Apps". These categories recorded 2 Apps each. The table below shows the number of Apps recorded per each of the categories in this study (see Table 3).

With regards to the highest number of Apps with a common number of downloads range, 44 Apps recorded a download range between 1,000 and 9,999. Also, 33 Apps recorded a download range between 100,000 and 999,999. Again, 23 Apps record a download range between 10,000 and 99,999. Further, 15 Apps recorded a download range between 100 and 999. Another 13 Apps recorded a download range between 1,000,000 and 9,999,999. Figure 6 displays various download ranges and the number of Apps that fall in each range.

## 4. Discussions of results

### 4.1 Summary of findings

*4.1.1 Applications per platform.* From the results in Figure 4, most of the Apps (52.20%) run on both the Android and iOS platforms. This can be attributed to the fact that most smart mobile devices in the world uses either the Android or iOS as the operating system/platform. Holst (2019) supported this point by stating that the global smart mobile operating system market share in 2018 showed that 99.9% of all smart mobile devices in the world run on either the Android or iOS platform. This meant that Apps developers had to produce Apps for both operating systems if they wanted to target the greatest percentage of the market share. This

| Categories of apps | Number of apps | Rank |
|---|---|---|
| Measurement and estimation apps | 28 | 2nd |
| Design and drawing apps | 29 | 1st |
| Management apps | 26 | 3rd |
| Construction site apps | 11 | 5th |
| Measurement, estimation and construction site apps | 4 | 7th |
| Drawing, design and management apps | 2 | 9th |
| Measurement, estimation and drawing apps | 4 | 7th |
| Management and construction site apps | 6 | 6th |
| Measurement and management apps | 3 | 8th |
| Drawing and construction site apps | 2 | 9th |
| All round apps | 21 | 4th |

**Table 3.**
Number of applications per Category
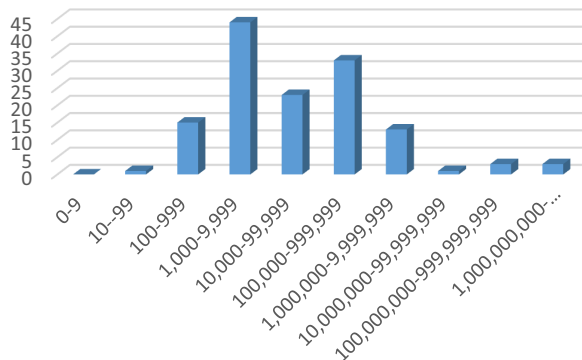


**Figure 6.**
Download ranges and the number of Apps that fall in each range

explains why most construction related Apps found in this study, mainly run on both Android and iOS.

Construction related Apps that run on only the Android platform came in second with a percentage of 27.95%. This is because, the Android platform according to Holst (2019), is the greatest mobile operating system platform in the world, currently controlling a market share of 88%. It is therefore not surprising that only Android based construction Apps from the study came in second in the result. Construction related Apps that run on only the iOS platform came in last with 19.85%. This is because the iOS platform controls only 11.9% of the market share (Holst, 2019).

The results therefore show invariably that most construction related applications can easily be accessed and used by construction professionals using devices which either run on Android or iOS platforms.

*4.1.2 Number of applications per category.* The results in Table 4 show that the categories with the highest number of applications, which were ranked as follows; measurement and estimation apps, design and drawing apps, management apps, all round apps, construction site apps, management, construction site apps, measurement, estimation and construction site apps, measurement, estimation and drawing apps, measurement and management apps, drawing and construction site apps and drawing, and design and management apps. A number of reasons may account for the positions of the various categories found in this study.

Measurement and estimation is one of the most important aspects of the construction process and its management. Measurement and estimation critical activities which enable the project team members to quantify the works and associated resources such as materials and labour. Such information on the construction works provides the bases for obtaining a fair idea of the cost associated with each work item and make budgetary allocation for it. Accuracy in measurement and estimation is therefore very crucial for the success of every project as it eliminates factors that impede progress such as material shortages on site and bankruptcies. This explains why most applications have been developed to make measurement and estimation easier and more accurate.

Design and drawing apps category came in second according to this study. This could be attributed to the fact that every construction project begins with a concept in the form of drawings and later, designs (structural and other details). The easier and faster the drawings and designs can be created, represented and shared, the shorter the whole design process becomes. This explains why many Apps have been developed to meet the drawing and design needs of construction professionals.

The category of "management" Apps came in third in this study. Management is defined by the Oxford Dictionary (2003) as the process of planning and controlling the use of material, human and plant resources to achieve a goal. This definition, underscores the crucial role management Apps can play in the construction process which may run throughout the entire project duration. Efficient management will lead to the right use of human resources, financial resources and time. This will result in completing the project on time, within budget and of the right quality.

| Name of app | Estimated download numbers | % Exposure of apps |
| --- | --- | --- |
| Autodesk Sketchbook | 10,000,000 | 4.76 |
| GPS Field Area Measure | 5,000,000 | 2.38 |
| MagicPlan | 1,100,000 | 0.52 |
| Measure | 1,020,000 | 0.48 |
| TSheets | 1,000,000 | 0.47 |

Table 4.
Percentage exposure of
the top 5 apps found in
this study

The all-round Apps ranked fourth in this study. All-round Apps are those that can be used for performing general tasks associated with construction operations or activities. All round Apps can be used by everyone involved in the construction process. These Apps usually address general but key issues in construction management such as safety, communication and minor calculations among others. Communication is the bridge that connects project team members in a harmonised fashion and it is an essential requirement for success in every project (Ochieng and Price, 2009; Yep, 2013). Safety of construction professionals is essential for completion of the project and the overall project success.

Construction site Apps category was ranked fifth in this study. The enormity of calculations that are required at every stage and in numerous trades in fragmented organisation as construction is what makes Construction Site Apps very useful. These applications are used on the construction site to aid with various activities on site such as carpentry, masonry and steelwork and several other trades. These works have to be done easily and accurately for better quality of work to be achieved.

*4.1.3 Applications with most downloads.* The Apps with the most downloads in this study were general Apps that could also be used in construction. These Apps such as WhatsApp Google Keep, Dropbox, Microsoft Office, Google Photos and Evernote had estimated downloads from 500,000,000 to 2,000,000,000. These numbers are more than the number of construction professionals in the world. They do not provide a realistic basis for ranking construction related Apps with the most downloads. Another reason is that they are not used exclusively for performing construction and related activities.

Autodesk Sketchbook is the construction related application with most estimated downloads (10,000,000). GPS Field Area Measure came in second with 5,000,000 estimated downloads. The third application was MagicPlan with 1,100,000 downloads. "Measure" was fourth with 1,020,000 downloads and TSheets, Invoice Maker, Spirit Level, Handyman Calculator, CamToPlan, Red Cross First Aid, Metal Weight Calculator, iHandy Level, Smart Ruler and All-in-One Calculator reached estimated downloads of 1,000,000.

These Apps had download numbers that are high because of their ease of use, good accuracy, compatibility on various smart mobile device platforms and their purchase price being less expensive.

*4.1.4 Exposure of apps.* The level of exposure of construction related Apps was measured using their number of downloads. That approach is based on an assumption that the more downloads an application had, the more construction professionals used it. This by extension gives the application more exposure in the construction industry. As displayed in Figure 6, the range of downloads with the highest number of applications was between 1,000 and 9,999. Also, 100,000 to 999,999 download range came in second according to the results. Again, the range between 10,000 and 99,999 came in third, 100 to 999 came in fourth and 1,000,000 to 9,999,999 came in fifth.

According to Nieuwenkamp (2016), the construction industry engages over 7% of the global work force. As of 2012, the world work force was about 3 billion according to Torres (2013). Using these values, the estimated total number of construction professionals in the world is 210 million. Comparing this number to the download numbers of the 136 construction Apps in this study, it can be concluded that the exposure rate of these Apps is almost insignificant. This was proved by taking the construction related applications with the highest download numbers and dividing them by 210 million (total number of construction professionals in the world). The resulting answer was then multiplied with 100% to obtain the exposure percentages. Table 4, shows the percentage exposure of the top 5 Apps found in this study.

From Table 4, it is seen that none of the Apps achieved a 5% exposure rate. Majority of the Apps achieved less 1% exposure rate. The indication is that construction related Apps have been underutilised by construction professionals. This finding confirms the findings of

Yankah and Owiredu (2016) that there exist low awareness and low utilisation of construction
Apps among construction professionals. This can be attributed to the fact that construction
professionals are used to and prefer to perform tasks using manual approaches. Also, lack of
trust in these Apps because of application bugs and crashes do not encourage construction
professionals to use them (Sattineni and Schmidt, 2015).

*4.2 Managerial implication*
This study highlighted the great potential of smart mobile device Apps in many industries
including the construction industry in terms of making work easier, boosting productivity
and improving efficiency. It was also showed that the adoption and use of construction
related Apps in the construction industry is slow as compared to other industries. This study
was therefore conducted to find and analyse various construction related Apps and their uses
and determine their exposure levels among construction professionals. The study began with
the familiarisation of the topic which led to the search for literature relevant to the study. This
initial search helped to find four key phrases which were used to develop four search
strategies to find construction related applications. 175 applications were found of which
there were 39 duplicates which were removed, with the remaining Apps totalling 136. The
applications were then placed into 11 categories.

Regarding the continuum of Apps in construction, the study found that more than half of
them run on both the iOS and Android platform which was attributed to the fact that over 99%
of the smart mobile devices run on these operating systems. This would enable the application
developers to target most of the smart mobile device users in the world. From the study, the
"Measurement and Estimation Apps" category was the category with the highest number of
Apps. It was followed by the "Design and Drawing Apps" category, "Management Apps"
category, "All-round Apps" and "construction site applications category" among others. The
applications with the highest number of downloads were the Autodesk Sketchbook, GPS Field
Area Measure, MagicPlan, Measure and TSheets among others. Even though there were other
Apps mentioned in this study with higher download numbers than the Apps stated, these
applications had general uses in other industries as well as personal lives in the world. Due to
that non-exclusive to construction characteristics, these Apps were not used in the rankings.

Various download ranges were developed to assess the approximated download numbers
of the various construction related applications. The "1,000–9,999" download range was the
download range in which most Apps fell. This information gave the impression that most of
the construction related Apps had very low download numbers. The exposure level of the
construction Apps used in this study were found by dividing the estimated download
numbers by the estimated total population of construction professionals and multiplied by
100%. From this, the highest exposure rate was 4.76, followed by 2.38 and 0.52 among others.
These values showed that the construction related Apps did not achieve an exposure level of
5%. The indication is low adoption and utilisation of construction related Apps by
professionals in the construction industry, even though accessing these applications were not
challenging since most construction professionals own a smart mobile device.

Therefore, to improve awareness or exposure and utilisation of construction related Apps
in the construction industry, training courses on the use of these Apps have to be part of
construction education and training so that construction professionals can fully utilise and
integrate the Apps in performing their tasks. Also, upcoming construction professionals have
to be educated on these applications in school so that they can use the Apps. Lastly,
construction companies should provide smart mobile devices with construction applications
installed on devices at workplaces in order to compel construction workers to the use of these
devices and applications in their daily work tasks. That can significantly increase in
productivity, ease of work and high efficiency in all its operations.

*4.3 Limitations of the study*
The limitations associated with this study are that the download numbers used are only estimated. This is because the platforms on which these devices run prefer to keep these numbers private and only accessible to the application developers. Another limitation is that there is no known procedure to establish if Apps were downloaded by construction professionals only. The study was designed based on assumption that all construction related applications downloads were done by construction professionals except Apps for general use like WhatsApp amongst similar others.

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