Preface

The growth of most developing countries, whose future prospects guarantee their emergence essentially, depends on the development of their infrastructures. Many of these infrastructures are nevertheless related to the construction of housing, roads, dams, hospitals, schools, various urban equipment, infrastructure facilitation and development of agriculture and energy. The construction industry is one of the sectors key to sustainable development (Passer et al., 2015). For generations, this sector has been challenged to deliver various services to the population. Similar to most developing countries, the increase in population has led to an acute demand of infrastructures for basic services such as education, health, highways, dams, communications, road networks and social lodging and so on. In addition to its basic role of providing shelter, the construction sector contributes significantly to the Gross Domestic Product (GDP) of both developing and developed countries, and plays an equally important role in the creation of employment. Its GDP contribution to the Ugandan economy in 2007-2008 period stood at 6%, with previous as high as 14.3% (Basheka & Tumutegyereize, 2012). In Nigeria, the industry is responsible for about 70% of the fixed capital formation and contributes 3% GDP (Adeyemi et al., 2006). The recent contribution to the GDP by the construction industry in Zambia stood at 29% in 2013 while Cameroon construction industry accounted for 3.4% of Gross domestic product in 2011, regardless of the current global economic downturn (AEO, 2012, 2013).

Despite this strong contribution of the construction industry in GDP, the construction sector has been noted for its frequent problems related to construction quality and cost mastering especially in developing countries. The direct consequences are cost overruns and delays, reflected when the project requires additional financial resources or execution times than those agreed between the client and the contractor. For a long time, statistics from most studies focused on construction projects in developing countries have revealed the depth of the cost overruns and delays. Al-Momani (1996) indicates that, before a project is completed, the actual cost exceeds the original contract price by about 30%, while change orders result in an 8.5% cost overrun. Odiyinka et al. (1997) indicates that 70% of the projects have been delayed
in their execution in Nigeria. Assaf and Hejji (2006) reveal that only 30% of projects in the developing world have been completed within schedule. Ndihokubwayo and Haupt (2008) reported that on average change/variation orders accounted for 4%-8% of the total contract amount for two apartment buildings in South Africa. Other developing countries where cost overruns and project delays have been reported in recent years are Zambia (Kaliba et al., 2009), Palestine (Ibrahim and Amund, 2012), Benin (Akogbe et al., 2012), Egypt (Marzouk & El-Rasas, 2014), Malaysia (Shehu et al., 2014), India (Doloi et al., 2014), Ghana (Addo, 2015; Amoatey et al., 2015) and Cameroon (Manjia et al, 2014).

There are many causes of construction cost overruns and delays. Although these causes depend on the different contexts of specific countries, the most important and common causes of cost overruns and delays encountered in developing countries include the insufficient financial means, the poor contract management practices, the shortage of materials supply, the inaccurate cost estimation techniques and overall prices fluctuations. These problems have not been addressed by the governments because of poor executive capacity, lack of resources, lack of commitment and neglect of the combination of the two complementary sectors (very often competitive) involved in the construction industry (formal and informal). In fact, the formal construction sector is an important source of activities while the informal construction sector mainly provides the bulk of the workforce. The interactions of teams from both sectors are related to man-power, materials and equipment, and funding sources. For example, the formal sector uses standard methods and a few skilled workers who have an official labor contract, and who are most often responsible for contacting the temporary workers usually unskilled and/or on-the-job trained, who are scattered in a given geographical area (district, city, town ...). In the informal sector, the unskilled workers are often called jobbers who do not usually have regular labor contracts which often cover any benefits such as social insurance, health insurance, retirement profits, and annual leave. As a result, it is not surprising that the informal workforce is usually very unstable. Furthermore, in the informal sector, the requirements of access to the banking credits are very difficult and selective making it challenging for clients and developers to obtain loans for any development projects. Thus funding sources for projects in developing countries are generally from Rotating Savings and Credit Associations (ROSCA) usually among members grouped by affinity, or money usury credits from private loaners (55%) which are usually refunded with high interest rates over a given period. This informal bank credits are predisposed to create delays or interruption in the construction project course.

Thus, interactions between formal an informal construction sectors involve many vulnerable conditions leading to risks and uncertainties that generate challenges in decision-making processes.
With regard to the challenges, it is therefore not surprising that, the construction industry in developing countries is characterized by low quality of construction projects, economic instability and a substantial inertia in use of modern materials and techniques. Thus, the mastery of construction parameters (cost, execution time and quality) is on the top agenda of the government of developing countries and constitutes an essential element of their development ambitions. While innovative technologies have been used by the developed countries to overcome problems facing the construction industry (eg Pert, Gantt, MS - Project, Uniformat II, Revit, Robot, Sketch-Up, Atlantis, Graitech, 3D-Max, Archicad, etc.), the challenges facing the construction sector in developing countries are significantly more complex. In fact, due to complexity of the challenges, they cannot be straightforwardly solved using the aforementioned classical tools. This is further exacerbated by the fact that the informal sector which is responsible of more than 80% of building construction (Pettang, 1995) has very little appetite in using the tools. The obvious complexity of the mastery of costs and lead times of infrastructure and construction projects certainly tends to be a huge burden for developing countries.

A very common to lessen the burden has been the formalizing *a priori* of the informal sector, in order to give it the required legal status. This approach has in most instances failed as it has so far led to the marginalization or exclusion of many actors and contributions, leading to a non-integration of a large number of stakeholders or workers from the informal sector despite the well-known benefits provided by the informal sector. As a consequence of this, many policies directed towards delivering affordable buildings and infrastructure projects have largely failed in developing countries, partly due to policies that restrict or limit the operating power of the informal sector. Therefore the urgent need or desire of developing countries to attain an emerging status requires a participatory approach where all actors including members of the informal sector are brought together to work collaboratively in delivering projects. That notwithstanding, there are inherent financial challenges that inhibit the proper functioning of the informal sector. Given the widening economic gaps between the developing and developed countries the former often seek external loans from developed countries and/or emergent countries for the realization of their infrastructure and in most circumstances they lack the required management and technical skill to completely manage a project on their own. Although obtaining loans is not a bad practice, there is anecdotal evidence that suggests donors impose strings on the loans which translates to so many l disadvantages to the stakeholder or debtor. This in turn limits the power of the informal sector to deliver buildings and infrastructure at the rate at which supply can meet demand. Yet, the construction sector is a main contributor to the economy of each country and is the main driver of development. Thus it is a sensible thing to consider the role of the informal
sector in the delivery of construction and infrastructure project. Paying attention
to the informal sector and addressing their challenges can potential payoff through
their contribution in project development.

Although considerable progress is still being made, this progress in improving
construction delivery efficiency and productivity has largely been due to the use of
decision support systems. Decision support systems are interactive, computer-based
systems that aid users in judging and making choice of actions or activities. There
are many benefits of decision support systems applied to various domains. These
include the improvement in efficiency, the clarity in complexity, the facilitation of
communication between individuals and the improvement of the quality of decisions.

There have been recent efforts by different researchers to address various aspects
of construction project management using decision support systems in Cameroon
for example. But, a wider and an in-depth knowledge of the applications of such
systems in that country are sketchy. Field experiences illuminate the knowledge
through questions encountered during the implementation of many projects. The
exploration of new mathematical tools is a requirement. The use of Information
Technology and Communication (ICT) tools will undoubtedly create profits and
conviviality for professionals and other stakeholders in the construction sector. In
fact, the contribution of ICT facilitates the de-complexification of cost mastering
through mathematical tools that provide quick and appropriated solutions based on
web interfaces, databases and other graphical user interfaces. This opens up new
fields, allowing researchers to strongly support building professionals in developing
countries whose environment is quite very complex.

This is the rationale as to why it is imperative to offer to construction stakeholders
a methodological approach of building cost mastering, based on some appropriate
selected decision support systems applied in construction in developing countries.
This methodological approach is fully discussed in this piece of work divided into
10 Chapters.

The general introduction of the book is presented in Chapter 1. In this chapter,
the analysis of the main issues or challenges associated with construction activities
in developing countries and Cameroon in particular are examined. Furthermore, the
role of decision support systems in overcoming the challenges such as improving
the efficiency and productivity of construction projects has been discussed.

In Chapter 2, the overview of construction practices in both the formal and informal
sectors of the construction industry in developing countries has been examined.
In examining the practices, focus emphases was laid on Cameroon, the main focus
of this book. The identification of key players and their relationships involved in
the delivery of construction projects in developing countries and in Cameroon in
particular have also been examined.
To provide the knowledge gap that underpinned this, a closer examination of problems plaguing the construction industry in developing countries and Cameroon is examined in Chapter 3. Further, the need of decision support systems in solving the different challenges in the management of construction projects identified in this chapter has been established.

Based on the challenges identified in Chapter 3, the need for decision support systems was established. To facilitate understanding, in chapter 4, an overview of the different decision support systems has been undertaken. Given that the core of this book is about decision support systems, in the early parts of Chapter 4, it was imperative to provide a working definition of decision support systems. To provide insights of their applications, the different decision support systems examined were those that have been used in construction.

Given the desperate parameters often captured in decision support systems, Chapter 5 was dedicated to understanding the mathematical models that capture the various parameters and their relationships. Based on the choices of the decision support systems, selected mathematical theories underpinning decision models have been explored. Some notable decision support systems considered are regression models, artificial neural networks, Matrices, Markov decision processes and the ontology rule-based decision support systems.

In Chapter 6, the analysis of some modeling principles underlying the chosen decision support systems was examined. The rationale behind reviewing the modeling principles was to facilitate understanding of their applications.

After examining the modelling principles of underpinning based decision support systems applied to construction in Chapter 6, Chapter 7 focused on selected case studies illustrating the detail applications of decision support systems in construction practice. Specifically, the mathematical modeling of sub-works principle, work quantity principle, time-schedule addition, workforce mastering, sub-works chaining diagram and costs indexes have been examined. The principle of cost modeling by sub-works classifies any construction project into three groups including the major works, the finishing stage works and the site installation works. According to this classification, the construction costs could be represented by 2 models (Pettang, 1997): MFI (Main fabric works, Completion works and Site installation works) and MLME (Construction materials, Labour, Management method and Equipment)). The principle of matrix calculation model enables the quick calculation of cost components (labour, materials, equipment and management) in most software programs. This modeling approach is aimed at aiding project managers to overcome challenges encountered during project delivery in developing countries. The sub-work chaining diagram (SWCD) presents a double advantage: the duration of execution of a sub-work being relatively short, we avoid the dispersion of financial resources in the expenditure other than the ones planned for the works. For example, a housing
project can be habitable at a certain stage of execution. Then, the promoter could reinforce the allocated budget for the construction and he could increase his savings. This last aspect is important in developing countries where the greatest majority of the population lives on a modest income, which does not allow them to engage in construction project, without significant and frequent disruption until completion.

After examining the different selected case study applications of decision support systems in Chapter 7, in Chapter 8, only one decision support system was explored. The rationale behind this was to gain a very detail understanding of the application of decision support systems in construction. Specifically the rule-based ontology decision support system was chosen. This is because rule-based systems are more encompassing and can easily be employed to deal with complex decision about construction activities. Emerging concepts such as Semantic Web technologies with focus on Semantic Web Rule Language (SWRL) have been examined in detail in Chapter 8. The purpose for choosing SWRL was to illustrate the capability of reasoning over construction information.

In Chapter 8, the underpinning theory of rule-based ontology systems were examined. Based on what has been covered in Chapter 8, the implementation of the rule-based ontology system in software environments have been examined in Chapter 9. The main rationale behind the implementation in software environments is to facilitate the automation of computation and reasoning. Furthermore, a detailed case study application in Software Environments has also been examined.

The overall conclusion of this book is presented in Chapter 10. The Chapter provide perspectives on how to modernize the construction industry in developing countries. The discussions about modernity the construction sector was largely focused on improving informal sector to substantially embrace innovative approaches and sustainable techniques in delivering construction projects. The aspect of sustainability could not have more timely than now, where climate change impacts are being felt globally. At the time of finalizing this book, the Conference of the Parties (COP) 21 was barely a week away from being held in Paris, France. Even before COP21 many other events have been highlighting the dangers of climate change and the need to curb impacts from all sectors. For quite some time now, the impacts from the construction sector has been noted to be too great and needed more aggressive mitigation measures to be implemented. Therefore concerted efforts from both the developed and developing countries are needed in mitigating climate change impacts. In practical terms, this requires construction projects to more sustainable than ever before. This translates to less or zero energy waste, less or no emissions and less or no construction waste. This is where the role of decision support systems is of great value as it provides opportunities to assess construction projects for compliance with the aforementioned targets. The role of decision support is even more important given the context of the informal sector where quality and productivity is highly
desired. In fact, the improvement of the informal sector will allow the construction sector to improve productivity size and quality. This will be of immense benefit to developing countries as they strive towards attaining emerging economies status. With regards to Cameroon, the government places construction and infrastructural development at the heart of its agenda towards attaining the emerging economy status in 2035. Sustainability will be key to delivering construction and infrastructural projects that will meet the needs of the population from now on especially with regards to 2035 in Cameroon. Although this book does not expand or cover in greater detail construction from sustainability perspectives, this Chapter provides at least some preliminary foundations. It is hoped that in a future edition, the aspect of sustainability will be strongly considered.

This book offers an extensive examination of decision support systems applied to construction in developing countries with focus on Cameroon. This book targets a wide community of readers that includes postgraduate researchers, researchers, decision makers and construction professionals. It is important to note that, although the decision support examined used illustrations from Cameroon, the same concepts could be applied to other developing countries especially those with similar characteristics.

It is only by involving the aforementioned interest communities that the true benefits of decision support systems can be realized. That notwithstanding, there is paucity of data about quantitative benefits of decision support systems despite too much qualitative claims in the literature. Upon extensive research of the literature, emerging Building Information Modelling (BIM) which is also been used in making decisions about construction processes is revealing some quite significant results. In the UK, the MoJ adopted BIM in delivering the Cookham Wood project (value of £20 million), that yielded a 20% cost saving. In Finland BIM adoption in housing projects have led to the following benefits: increase profit margins of 45%, waste reduction of 45%, on-site accident reduction of 5%. The strength of BIM lies in the fact that decisions can be made virtually with various alternatives explored before realizing the real project on site. This is the fundamental theory behind all most decision support systems.

REFERENCES


