THE FUTURE ROLE OF A QUANTITY SURVEYOR IN SOUTH AFRICA

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The quantity surveying profession is facing irrevocable and fundamental change arising from technological innovation and the automation of professional work. Referred to as the 4th industrial revolution, this change is both radical and transformational for the profession. This study seeks to understand this change so as to provide models of the future role of the quantity surveyor in the construction industry in South Africa through scenario planning. A review of literature proposes Geels's multi-level perspective (MLP) as a conceptual framework to understand revolutionary socio-technical transitions in industries and sectors. Scenario planning is reviewed as a methodology to investigate how the quantity surveying profession is currently constituted and the capacity of the current systems and structures within the profession to manage the envisaged changes. The findings reveal that there is consensus that the professions are going through change and this change will also impact on the quantity surveying profession. MLP is a suitable way to conceptualise fundamental change and the impact on the multi-levels of institutions. Scenario planning is an appropriate methodology for the QS profession to engage with and understand the challenges that the profession will face as a result of these socio-technical changes. MPL and scenario planning are useful in understanding change in the quantity surveying profession. They can be applied to understand change in other professions and institutions.

Keywords: Quantity Surveying, Profession, Multi-Level Perspective, Change, Scenario Planning.

INTRODUCTION

Quantity surveyors have evolved from "brick counters" to being regarded as highly skilled professionals in construction costs and contractual issues within the construction industry (Llale, 2015). Current technological innovations in the construction industry are threatening the existence of the profession in its current state. Some of the newer technologies have the potential to replace some of the core functions of the quantity surveyor. If core quantity surveying functions are replaced by new technologies what will the future role of quantity surveyors be? The study highlights the evolution of the quantity surveying profession in the past and the forces that have impacted its evolution and those that are likely to affect it in future. It also advocates for the application of multi-level perspective (MLP) as a conceptual framework for understanding revolutionary socio-technical transitions. Socio technical transitions incorporates changes not only in technology but also in associated markets, user practices, policy and cultural meaning (Geels, 2004). Scenario planning is proposed as a methodology best suited for projecting the future role of quantity surveyors in the construction industry.

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THE FIRST INDUSTRIAL REVOLUTION AND THE EMERGENCE OF THE QUANTITY SURVEYING PROFESSION

The first industrial revolution (1750-1850), which begun in Britain, is regarded as a period of fundamental change in the history of the world (Berg & Hudson, 1992). Society transformed from being agrarian to industrial. Machinery and factories accompanied by urbanization were some of the hallmarks of that era. There was an emergence of many professions including the quantity surveying profession. In fact, industrialisation is associated with professionalisation. Marxists purport that industrial capitalism influenced the development of the professions (Susskind & Susskind, 2017).

Henry Cooper and Sons of Reading, the first quantity surveying firm, was established in 1785 in the United Kingdom. Before 1859 “quantity surveyors” were called "measurers", "custom surveyors" or surveyors" (ASAQS, 2014a). Quantity surveyors were initially employed by tradesmen or builders to determine the cost of the building works before being directly employed by the building owners (Rashid, Mustapa & Wahid, 2006; Maritz & Sigle, 2016).

Tradesmen or builders employed their own quantity surveyor, who measured quantities and estimated the cost of works from the drawings prepared by the architect (Graham, 2010). As a cost reduction measure, tradesmen decided to employ one quantity surveyor, who measured the works and estimated the cost of the works, instead of each builder having his own quantity surveyor. The cost of the quantity surveyor was shared among the tenderers (ASAQS, 2014a; Maritz & Sigle, 2016). The document that quantity surveyors used to compile quantities and to solicit tenderers was called the bills of quantities (ASAQS,2014a).

What Winch (2010) refers to as the “professional system” in the construction industry was firmly entrenched by the 1860’s that, `…no reputable builder would tender unless quantities were supplied by a recognized quantity surveyor [and] the taking out of quantities required very full working drawings and specifications from the architect’ (Summerson, 1973 p. 13 in Winch, 2010). One of the fundamental features of the professional system is the selection of the contractor based on the lowest priced tender following a competitive tender process. The driving force behind the selection lowest tender is the the client’s desire to obtain the best deal (Winch, 2010).

The second industrial revolution and the quantity surveying profession

The second industrial revolution took place between the period of 1860 and 1900. The period was characterised by rapid inventions of new technologies, including electricity. However, there was little change in productivity levels mainly because of manufacturers’ affinity and vested interest to old technologies (Atkeson & Kehoe 2001). It was during this period that the quantity surveying profession was introduced to South Africa through British architects as a result of the discovery of diamonds and gold in 1870 and 1886, respectively. South African quantity surveyors adopted the London system of measurement and issued quantities. After the Anglo-Boer war (1899-1902) and the establishment of the Union of South Africa in 1910, investment in the construction industry in South Africa increased. This resulted in increased formalization of the construction industry and the convergence of methods and practices with that of the UK. The professional body promoting the development of the quantity surveying profession was the Transvaal Society of Quantity Surveyors

(ASAQS, 2009). The South African Council for the Quantity Surveying Profession (SACQSP) is currently the jurist person mandated by the Quantity Surveying Profession Act, 2000 (Act 49 of 2000) to regulate the profession.

The third industrial revolution and the quantity surveying profession

The 3rd industrial revolution is estimated to have begun in the 20th century in the 1970s. The main characteristic of the third revolution is that production became digitally automated through electronics and information technology (Bloem, Van Doorn, Duivenstein, Excoffier, Maas & Van Ommeren, 2014). Social change was influenced by "…intelligent mechatronics that automate a part of the brain" (Kunii, 1997).

In a report published by the Royal Institution of Chartered Surveyors (RICS) in 1971, the work of the quantity surveyor was described thus;" …ensuring that the resources of the construction industry are utilised to the best advantage of society by providing, inter alia, the financial management for projects and a cost consultancy service to the client and the designer during the whole construction process." (RICS,1971 in Ashworth, Hogg & Higgs, 2013).

The construction process involved quantity surveyors preparing estimates of approximate estimates based on the architect's initial designs. Once the estimated cost was accepted by the client, the architects would develop their designs further. From the architect's designs, quantity surveyors would prepare bills of quantities for tendering purposes. During the construction period interim payment would be issued based on the bills of quantities. On completion of construction a final account was prepared. In this process referred to as the measure and value system, the quantity surveyor performed what is regarded as his traditional role (Ashworth et al., 2013). Most quantity surveyors in South Africa still practice the measure and value system today.

One of the disadvantages of the measure and value system is that it is fragmented and litigious mainly because contractors and sub-contractors are not involved in the design stage of the process (Cartlidge, 2006). In this system contractors' claims for additional payment are common (Ashworth et al., 2013). As a result, there has been a need to change this system. Other factors that have necessitated the evolution of the quantity surveying profession in the UK has been, changes in the markets, globalisation, changing client needs, privatization and public private partnerships. Investment appraisal, whole life costing, value management, facilities management and programme management are some of the tasks that were added to the quantity surveyors as a result of the evolution (Cartlidge, 2006). However, in South Africa, the measure and value system remain largely unchanged. Politics, the economy and construction technology, particularly the introduction of steel and concrete in construction (ASAQS, 2009; Maritz & Sigle, 2016), have had a major influence on the evolution of the quantity surveying in South Africa.

However, both the second and third industrial revolution merely caused the automation of certain functions and procedures of the quantity surveyor. The profession was able to change and adapt to the demands made upon it by these changes (Ashworth et al., 2013). However, the fourth industrial revolution is set to revolutionize the profession in that new technologies have the potential to replace the quantity surveyor.

The influence of the fourth industrial revolution on the professions

According to Brynjolfsson and Mcafee (2014), we are currently living in an era where digital technologies are going to enhance and bring revolutionary change in society like the steam engine steam did in the in the 18th century. They argue that machines "…will in the near future diagnose disease more accurately than doctors." This view is also supported by Susskind et al. (2017) who claim that professionals underperform in their duties and in future their services will not be needed in the manner and method they are currently discharged to society. Undoubtedly the quantity surveying profession will also be affected by this wave of change.

Quantity surveyors have been amongst the first in the construction industry to embrace technology such as spreadsheets, word processing and bill production software to perform some of their duties more efficiently (Cartlidge, 2006). Building information modelling (BIM), is currently causing the construction professionals to have a fresh look at the manner and methods they use to provide their services.

BIM is described as," …a rich information model, consisting of potentially multiple data sources, elements of which can be shared and be maintained across the life of the building from inception to recycling (cradle to cradle). The information model can include contract, specification properties, programming, quantities, cost, space and geometry" (NBS in Ashworth et al., 2013).

Kulasekara, Jayasena and Ranadewa (2013) argue that BIM has the potential to transform every aspect of the construction industry including the construction professional functions and boundaries. Table 1 shows some of the traditional tasks of a quantity surveyor they claim can be replaced by BIM.

Table 1: Traditional quantity surveying tasks vs BIM alternatives (Kulasekara et al., 2013)

Traditional Quantity Surveying task	BIM alternatives to the traditional QS tasks
Quantities take-off	Autodesk QTO, BIM Measure from Causeway
Bills of quantities preparation	CostOSTM, Nomitech
Cost estimation	DProfiler, Beck Technology
Cost planning	Vico Cost Planner
Cost reporting	Vico Office Client
Cost control	Vico Office Explorer
Material procurement	Quantities of material can be obtained using BIM tools
Payment application	Bentley
Value management	BIM tools can be used to obtain the estimated costs of various design options
Life cycle costing	Integrated Environmental Solutions Vitual Environmental

Bills of quantities forms a very important part of the quantity surveying profession in South Africa even though bills of quantities' usefulness in the UK has declined (Rashid et al., 2006). However, the process of bills production is time consuming and error prone. Errors associated with data transfer from one file to the other, missing taking off elements and double accounting are common (Baldwin & Jellings in Kulasekera et al. 2013). BIM can potentially reduce this risk associated with such errors. Ashworth et al.,2013, claim that by using BIM, bill production time can be reduced by as much as 80%.

Other technological changes in the construction industry that have the potential of changing the quantity surveying profession include; standardization and offsite construction, the use of common ICT and information-sharing platforms (e.g. Common Data Environments), automation and the use of robots, 3D technology (3D printing of buildings) and new/smart construction materials (Harty, Goodier, Soetanto, Austin, Dainty & Price, 2007). These technological changes have the potential to cause a decrease in skilled labour as robots and some technology can perform some of the work that humans do even better in terms of quality and speed. ICT and information sharing platforms can potentially result in a blurring of professional lines. On the economic side the construction industry can expect; 1) pressure for a more profitable, efficient and competitive construction industry, 2) globalization, a consolidated and defragmented construction industry; 3) a wider use of whole-life costing, and 4) Public Private Partnerships (PPPs) and Private Funds Initiatives(PFI) (Harty et al., 2007).

Thus, the fourth industrial revolution has the potential to fundamentally change the organization and structure of the construction industry and upset the current roles of its professionals on an order of magnitude of the first industrial revolution which led to the disappearance of the master builder. Although the second and third revolution brought some changes in the construction industry, the changes they brought were evolutionary. They did not disrupt the status quo in respect of the underlying socio-technical process. In contrast fourth revolution has the potential to bring transformational change. It will disrupt the status quo. The type of change envisaged will affect the construction industry and its professional at their core.

Ways of looking at revolutionary change

To try and understand how this change will unfold, it is necessary to look at how such technological changes can be conceptualised. While there are other ontologies to look at change, such as conflict theory, functionalism and symbolic interactionism, the multi-level perspective (MLP) framework provides a more comprehensive perspective for understanding multi-dimensional complexity of transitions in socio-technical systems (Geels, 2010). The multi-level perspective arranges the analysis of transition into a socio-technical system that comprises of three heuristic levels; niches, regimes and landscapes (Smith, Vob & Grin, 2010; Geels, 2005). Technological niches form the micro-level where change originates. In the construction industry, the actors in niches are made up of individual professionals, firms, researchers, etc. Socio-technical regimes form the meso-level and the macro-level is formed by a socio-technical landscape (Geels, 2005). The socio-technical regimes refer to institutions that regulate the activities of the industry such as the Councils for the Built Environment (CBE), the Engineering Council of South Africa (ECSA), SACQSP, policies, standards, norms, etc. The socio-technical landscape refers to the technology-exogenous environment factors such as the macro socio-economic and political factors. The three levels are independent of each other even though there may be elements of co-evolution. Change take place when there is interaction between the three levels (Geels, 2005).

Geels (in Van Ewijk, nd) defines MLP thus; "…the multi-level perspective (MLP) is a middle-range theory that conceptualizes overall dynamic patterns in socio-technical transitions. The analytical framework combines concepts from evolutionary economics (trajectories, regimes, niches, speciation, path dependence, routines), science and technology studies (sense making, social networks, innovation as a social process shaped by broader societal contexts), structuration theory and neo-institutional theory (rules and institutions as 'deep structures' on which knowledgeable actors draw in their actions, duality of structure, i.e. structures are both context and outcome of actions, 'rules of the game' that structure actions). […] The MLP views transitions as non-linear processes that results from the interplay of developments at three analytical levels: niches (the locus for radical innovations), socio-technical regimes (the locus of established practices and associated rules that stabilize existing systems), and an exogenous sociotechnical landscape (Rip and Kemp, 1998; Geels, 2002, 2005 in Van Ewijk, S, nd)."

Geels (2005) refers to the relationship between the niches, regimes and landscape as a "nested hierarchy" where regimes are set within the landscapes and the niches within the regimes. There are four phases of transition in a multi-level perspective framework. The first phase involves the emergence of innovation in the niches. The second phase occurs when the innovation is used in technical specialization in a small market niche. The third phase occurs when there is a breakthrough in the new innovation that involves wider application and competition with the incumbent regime. The fourth phase occurs when the new innovation replaces the old regime. The new regime may influence the socio-technical landscape to change. From an MLP perspective, transitions are non-linear and unpredictable (Geels, 2005). Figure 1 illustrates how transition takes place in a MLP framework.

The current changes taking place in the construction industry are unprecedented, uncertain and involve various stakeholders. They will require a multi-level perspective framework to fully comprehend and prepare for.

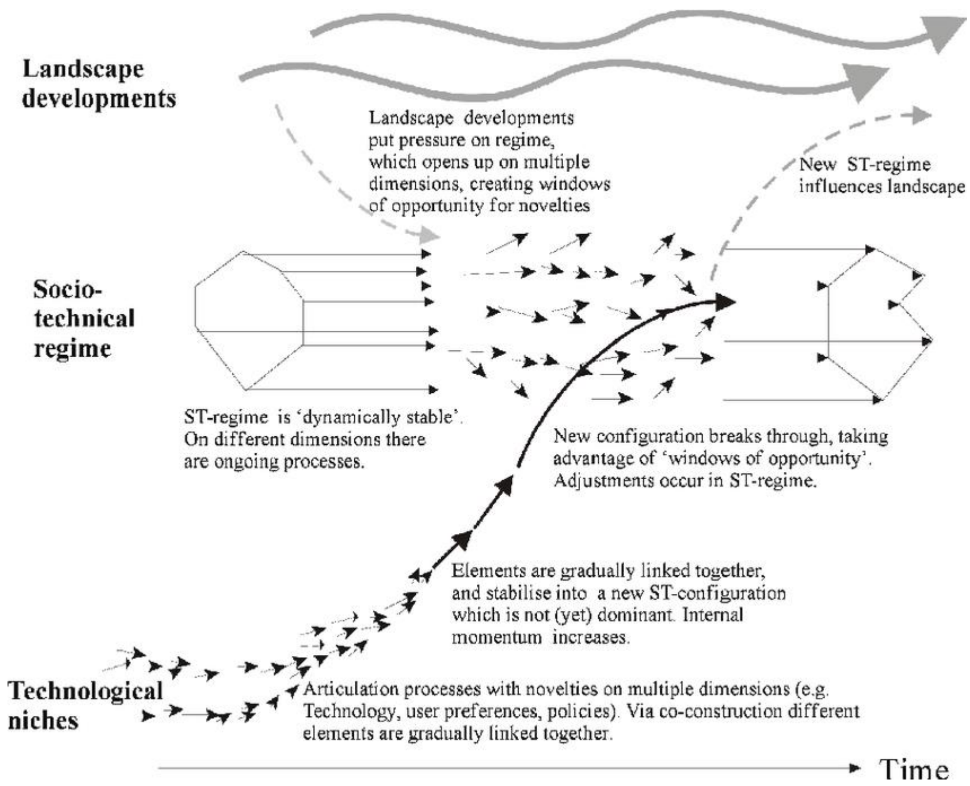

Figure 1: Multi-level Perspective (Adapted from Geels, 2005).

Exploring the MLP through scenario planning

Scenario planning is one of the methodologies used to project or predict the future in future studies. Future studies are described as "…a field of studies, focusing on a methodical exploration of what the future might be like" (Forward Thinking Platform, 2014). Since the future in unknown methodologies for studying the future differ from conventional scientific research methodologies. The conventional research methodologies rely on existing data or on data that can be generated, which future studies do not possess (Groff & Smoker, 1997).

Some of the main methodologies utilized to project or predict the future include; trend extrapolation, technological forecasting; Delphi technique, and scenarios. Trend extrapolation is concerned with studying past trends and projecting them into the future with the assumption that the future will, to some extend, resemble the past. Technological forecasting seeks to predict future technological changes including when they are likely to happen (Groff & Smoker, 1997). The Delphi technique is a method of obtaining and sifting expert opinions about a probable future or preferred future (Dalkey 1967, Brown 1968 in Lang ,2001; Groff et al., 1997). Rialland and Wold (2009) define scenarios as;" …structurally different stories about how the future might develop, that are believed to have an impact on the field/businesses on focus."

Shoemaker (1991) claims that scenarios as a preferred research methodology are most useful where; 1) the level of uncertainty is high and cannot be predicted, 2) significant change in the industry has occurred or is about to occur, 3) there have been too many costly surprises in the past, 4) fewer new opportunities are identified and created, 5) strategic planning is poor in quality, 6) there are differences of meritorious opinions about the future, a common framework and language is sought and 7) where competition is using scenarios.

Trend extrapolation cannot produce reliable forecasts for medium to long range future because they provide a single-figure forecast. The level of uncertainty within this single-figure forecast is usually difficult to estimate. Scenario planning on the other hand provides multiple scenarios that attempt to bind inherent future uncertainties in multiple scenarios. By observing 1) causal relationships, 2) prevailing trends, 3) the behavior of key stakeholders and 4) internal consistency, multiple scenarios about the future are developed (Shoemaker,1991).

According to Goodwin and Wright (2001), even though scenario planning lacks the theoretical and axiomatic underpinnings of other decision-aiding tools such as decision analysis and statistical forecasting it has a number of advantages over them. One of its advantages is that it precludes the need to estimate probabilities and thus avoids biases associated with subjective probabilities (Goodwin & Wright, 2001). The presentation of future scenarios as stories makes them likable, conversational and memorable (van der Heijden, 1994 in Goodwin et al., 2001; Chermack, 2004)). According to Chermark (2004) scenario planning can potentially address four core causes of unexpected decision failure; "…1) bounded rationality, 2) the consideration of exogenous and endogenous variables, 3) information stickiness and knowledge friction, and 4) mental models and decision premises."

In scenario planning the future is not a singular concept but a plural concept. Scenario planners seek to identify a number of equally plausible futures, usually two to four different futures. Scenarios are developed through a five-step methodology. Firstly, by identifying what the client wants to know within a specific time frame. For example, what are the long-term implications of BIM on the quantity surveying profession? Secondly, every economic, social and political factor that might influence that question are identified. Thirdly, trends in the socio-economic and political trends are grouped into groups of related major trends. The fourth step involves ranking the trends according to their likely impact on the question at hand and its associated uncertainty. The ranking is done using a two axes graph. In the fifth step possible sudden shifts in trends are identified by plotting the trend of the highest impact against the trend of the greatest uncertainty (Cronje, 2017).

Scenario planning compels stakeholders to consider both exogenous and endogenous variables and forces that are impacting or might impact an organization or profession (Chermack, 2004). Given the multiple trends that are currently having an impact on the quantity surveying profession a single future forecast of the future quantity surveyor will not assist the profession to adequately prepare for the future as the future is not singular but plural. There are at least more than one plausible futures for the quantity surveyor and thus scenario planning provides a useful methodology for projecting its future.

CONCLUSIONS

There is enough evidence to suggest that the construction industry and its professionals are on the brink of fundamental change that will require proper understanding and preparation. Unless the envisaged changes are properly understood, analysed and prepared for the envisaged inevitable change will leave many casualties. Hence a multi-level perspective framework and scenario planning are recommended for understanding the change and preparing for it.

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