The evolution of engineering services management

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Engineering and technology management is an evolving discipline globally. The increasing complexity of engineering systems and activities, the scope and sophistication of resources, and advances in technology have all been driving forces in the rapid evolution of this field.

In reaction to the complexities of engineering and technology management, the Graduate School of Technology Management (GSTM) was established at the University of Pretoria on 1 January 2007. Its technology management programmes are aimed at engineers and scientists who have recently completed bachelor's degrees. The objective is to produce engineers and scientists who not only have skills in technology, but also the ability to manage technology.

The first engineering services management (ESM) courses were launched in 2009 and evolved into a fully fledged discipline within five years. One of the first papers emanating from the author's year-long research study to determine the relevance and feasibility of establishing "service science" as a potential field of study at the GSTM was published in the *South African Journal of Management* in 2008.

The paper, entitled "The service economy: A South African perspective", reflected one of the study's key findings: although the services sector had emerged as the dominant sector of the global and South African economy, as far as could be ascertained, there were no academic institutions in sub-Saharan Africa that offered courses on services management in an engineering context. This needed to be seen in the context that many leading academic institutions in the USA, Asia and Europe had already established services science management and engineering (SSME) as a field of research and tuition.

From 2004 to 2006, the IBM Corporation's Global Innovation Outlook (GIO) brought together business and community thought leaders from four continents and 178 organisations to identify and discuss emerging trends, challenges and opportunities that affected business and society. They identified services as the sector of the economy that held the key to future sustainable growth. Considering the socio-cultural and human dimensions involved, as well as the need for innovation in competing in the services marketplace, integrating technology into new business models and processes became a recurring theme in contemporary literature.

Prof Tinus Pretorius and Dr Siebert Benade of the GSTM identified the services management trend as an area of study to be pursued. They took the initial steps to establish ESM as a field of research and tuition at the GSTM. They requested the author to develop such a curriculum, while considering international experience.

Discussions were held with staff from Portland University and academics from various international academic institutions in drafting the proposals and academic content. It soon became apparent that the scope and content of the envisaged ESM course was extensive. A lot of material had to be covered to equip students with the knowledge and skills required for the development, implementation and management of an effective services infrastructure. As a result, the first course was structured to deal with only the fundamentals of service science, and a more advanced course was to be introduced later to cover the more pertinent aspects relating to practical issues. The introduction of these courses necessitated the identification of research topics and themes for students to consider in completing the research projects required for completing their degrees.

In 2009, students could register for the ESM course for the first time. As it dealt with the fundamentals of service science, it was clear from the start that most of the students could relate the course's theory to their individual situations at work.

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Bringing theory and practice together was an important consideration in the development of the course. Within two years, the demand for the advanced course became apparent, and it was successfully launched.

Since then, the number of students registering for the courses has increased significantly. In 2013, ten students undertook the first research project in the field of healthcare services management. The project was quite extensive and, together with Dr Louwrens Erasmus, the author worked with students to gain an understanding of technology's role in supporting healthcare service delivery. The research findings resulted in a number of papers being published and presented at local and international conferences. Servitisation was another research project that resulted in a significant number of journal articles and conference papers.

With the establishment of ESM as a domain of research and tuition at the GSTM, theory and practice converged. Insight gained from the research was integrated into the courses. One significant event was the development of a service systems framework. This framework has been adapted and used in a number of service-related fields. These include healthcare services management, and electricity generation and distribution. It now forms one of the building blocks for service systems design and management.

Over only five years, ESM has evolved from its humble beginnings into a fully fledged discipline. As they evolved, it became necessary for the ESM courses to be constantly adapted and updated. A major change was the revision of the information technology (IT) course that integrated IT and service systems theory. The IT component was consequently

removed from the advanced ESM course, which had become too extensive in scope and content.

Since their inception, one of the fundamental challenges in developing and presenting the ESM courses has been determining what service science knowledge and skills need to be included in the courses. Service science theory and practice do not remain static long enough for academics and practitioners to catch up and integrate innovative new thinking and management practice into course material.

The field of healthcare service management has experienced particularly significant and innovative technology-driven progress. In recent years, there has been a significant increase in unstructured data in this field. This data emanates from diverse sources, such as medical research,

imaging, multimedia and even social networks, and needs to be analysed. The same is taking place in related service-oriented fields, such as travel and transportation, leisure and hospitality, finance, education and local government, making it extremely difficult to ensure that appropriate knowledge transfer takes place.

It is hardly surprising that no less than three editions of the textbook have been published since ESM was established at the GSTM, and the course material had to be revised in each case. Making sense of the large amount of service science data generated in these settings and this field of research is a future challenge that has to be addressed. The notion of personalised services and patient-centric healthcare will fundamentally change the way services are rendered in the future. It will no longer be a case of one size fits all.

Many of the innovative technology-driven changes are disrupting service delivery trends and processes. Personalised healthcare patient treatment is an example. Therefore, there is a need for moving from traditional incremental adaptive change strategies to embrace emergent service management practices and their technology support systems. It will necessitate the need for a culture of continuous learning and exploration, as well as the demise of traditional boundaries between technology and its application in service delivery. This will play a significant role in the evolution of future ESM course curricula and the material covered to ensure that GSTM students remain at the cutting edge of service design and management.

The importance attributed to this stems from the role that services play in both the global and South African economy. According to the World Economic Forum, services currently account for 67% of the country's gross domestic product (GDP). Servitisation strategies are also increasingly implemented in the manufacturing industry to gain a competitive advantage in global and local markets. Maintenance and repair services during the operating life of products

add an additional revenue stream that, in many instances, is even greater than the cost of the original product itself. It is frequently argued that we have passed the tipping point where the knowledge-based services economy emerged as the dominant sector of the global economy.

Seen in the context of the emergence of a technology-driven services economy, it can be assumed that service science will become increasingly relevant and important in an engineering context. The need to gain a greater share of the global services market will also be given impetus by the prevailing, relatively sluggish South African economy and the more stable revenue stream generated by services.

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The ESM domain will have to focus on two increasingly important aspects that will have a significant impact on the evolution of research and tuition in this field. These factors are the disruptive trend breaks in technology service support systems and the innovation in service systems in diverse sectors of the economy. Several major transitions in technology, each important in its own right, are combining to reshape the services landscape. These transitions include mobile and cloud computing, the increasing emphasis on big data analytics and the pervasive effect of the internet. Making sense of the effect of the innovative changes will in itself complicate service strategy development and implementation. Disruptive technological trends and their impact in an African context will consequently feature quite prominently in the ESM domain at the GSTM in future.

It can be expected that, with the unprecedented growth in the knowledge-based services economy,

the need for technology-oriented service management skills will intensify and outstrip the availability of these skills. The use of technology to enable personalised service-based skills development is envisioned as a possible means of bridging the gap between a shortage of the required skills and the industry's demand for appropriate skills.

It is suggested that the evolution of the GSTM's ESM domain now stands at the brink of needing to find new innovative means of bridging this skills gap, which will only widen if it is not addressed. A possible solution could be the development and presentation of industry-specific service-based skills using new technology-enabled means of distance education. Industry-based data analytics can assist in identifying the essential skills required in specific spheres of service delivery, such as tourism, healthcare and the retail industry, thereby enabling personalised learning pathways.

The GSTM will accept the challenge of researching and remaining at the forefront of proactive ESM-related skills development in the South African context. In this sense, the evolution of the ESM domain appears to be on a never-ending journey of becoming more relevant in an innovative, technology-driven and dynamic services economy. ⊕

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