

HSE&IH PROGRAMME BROCHURE

THE VISION: A HEALTH SYSTEMS ENGINEERING & INNOVATION HUB (HSE&IH)

GlaxoSmithKline (GSK) a prominent global player in the pharmaceutical industry has entered into a grant agreement with Stellenbosch University's Department of Industrial Engineering to establish a **Health Systems Engineering and Innovation Hub (HSE&IH)**. Through the generous support from GSK in the form of a seed fund, the envisioned development of a HSE&IH will take place over a 10 year period. The unit will aim to develop professional, trans-disciplinary relationships and links with other research and policy networks. The geographical focus of the unit will be on Public Health Systems in sub-Saharan Africa with an ultimate long-term aim to train Health System Engineering and Innovation specialists for the continent.

The vision for establishing a HSE&IH is to develop research capacity and capacity in practitioners to support healthcare management decision making and to support the implementation and "operationalisation" of such decisions through the design and development of eHealth solutions, innovation platforms, supply chain networks, service delivery networks, information management, change management, project management and other Industrial Engineering knowledge areas.

Studies will also be conducted on policy development and support for adopting new methods, processes and other innovations in Public Healthcare delivery systems. The envisioned programme will create a platform for collaboration for the validation and development of healthcare technologies and proof of concept studies.

WHY HEALTH SYSTEMS ENGINEERING AND INNOVATION?

Worldwide, conventional approaches to the design of healthcare systems are widely acknowledged to be failing. This growing realisation is attributed to the increased pressure that healthcare providers are facing as they attempt to continue to provide quality services while maintaining control over escalating costs and limited resources. These complex issues require qualitative and quantitative modelling approaches to support the development of evidence-based solutions to address the contemporary questions facing healthcare decision-makers.

BOX 1: THE POTENTIAL OF HEALTH SYSTEMS ENGINEERING

The principles, tools, and research from engineering disciplines associated with the analysis, design, and control of complex systems disciplines have helped to improve and transform many manufacturing and other services industries. Here we refer to well established engineering disciplines such as Systems Engineering, Industrial Engineering, Operations Research, Human-factors Engineering, Financial Engineering/Risk Analysis, Materials/Microelectromechanical Systems Engineering. These are however largely unknown in the planning and delivery of healthcare and healthcare systems. We therefore propose the establishment of Health Systems Engineering capacity as a key strategic priority for better service delivery and care in sub-Saharan Africa.

Reid *et al.* (2005) contrasts between the instrumental role that engineering plays in the development of medical technologies and the support of medical research and the very limited application of engineering techniques to the design and management of the healthcare *delivery* system. They describe the complex nature of healthcare delivery systems (involving interrelated systems of distributed, specialised personnel, multiple information and material flows, specialised care facilities, financial resources, etc.) as well as the similarities between these

complexities and those found in other systems where systems thinking and industrial engineering techniques have successfully been applied to improve operations.

Brandeau *et al.* (2004) group the decisions facing healthcare policy makers and planners into two broad categories: (i) healthcare planning and organising; and (ii) healthcare delivery. Healthcare planning and organising is defined as encompassing high-level decision-making and includes decisions on the economics and structure of healthcare systems while healthcare delivery encompasses lower-level decision-making that is mainly concerned with the management of healthcare operations and with clinical practice. This structure and some examples of decision-making mechanisms are depicted in Figure 1 below.

Healthcare planning and organising	Healthcare delivery	
Healthcare system economics Budget and funding mechanisms Prioritisation of cost service	Operations management Supply chain design Facility location and layout Workforce planning and scheduling	Healthcare provider delivery mechanisms Remote diagnosis, Point Of Care Technology Transaction Processing Clinical decision support system Care plan management Appointment booking and management Service delivery Supply chain planning and collaboration: - Order tracking and delivery coordination Telehealth, mHealth E-Prescription - Prescription and test ordering support Electronic referrals and specialist letters Electronic health event summarises, prescriptions and test ordering Medications management Prescription and test ordering support Alerts monitoring and management Chronic disease management Clinical decision support Adverse event monitoring
Healthcare system structure Public versus private delivery Primary versus tertiary healthcare delivery Public resource allocation	Public health programme delivery Risk analysis Compliance monitoring and reporting Performance monitoring of service providers and programmes Skills evaluation Health-care operations management Clinical practice improvement Health programme design and optimisation Health policy development Clinical research, rapid access to information for disease surveillance, modelling	
Public healthcare decision making Planning to mitigate for environmental, lifestyle and infectious diseases risks Management of pharmaceutical supplies and vaccines		

Figure 1: Categories of healthcare management decision-making (Source: Brandeau (2004); Grobbelaar (2014))

Health Systems Engineering (HSE) is concerned with the design and planning of health systems as well as the delivery and management of operations through (i) quantitative modelling, forecasting and scenario analysis to support decision making; (ii) analysis to diagnose the root cause of systemic problems in the healthcare delivery process; and (iii) the application of Industrial Engineering skills to solve management and delivery problems in the healthcare sector.

THE RESEARCH: KEY THEMES AND FOCUS AREAS

By setting up **HSE&IH**, a multi-disciplinary environment will be created where innovators, health systems engineers and policy makers collaborate and research solutions related to improving healthcare delivery in sub-Saharan African Public Health Systems. The core suggested research focus areas could be summarised as outlined in Box 2:

BOX 2: RESEARCH FOCUS AREAS AND THEMES

Theme 1: Industrial Engineering applications for planning, organising and optimisation of healthcare service delivery. In this theme we apply Industrial Engineering capabilities such as Operations Research, supply chain design and facility design to develop bespoke solutions for the planning and delivery of public healthcare services.

Theme 2: Innovation and technology for improved and sustainable delivery and access to healthcare services. In this theme we explore how innovation and technology development may contribute to improved healthcare delivery and access to healthcare services across the sub-Saharan continent - specifically focussing on public healthcare systems.

Theme 3: Public Health Policy for Technology, Innovation and Development. In this theme we explore how Health System Engineering, Innovation and Biomedical Engineering may support and strengthen policy making. This theme will both draw on and inform studies conducted under Theme 1 and 2.

RESEARCH THEME 1: INDUSTRIAL ENGINEERING APPLICATIONS FOR PLANNING, ORGANISING AND OPTIMISATION

Through the Industrial Engineering applications for planning, organising and optimisation of healthcare service delivery theme we aim to apply Industrial Engineering capabilities such as Operations Research, supply chain design and facility design to develop bespoke solutions for the planning and delivery of public healthcare services. This may entail finding answers to the following questions and looking into the following aspects of healthcare delivery:

Delivery network design: Where should new healthcare facilities be built? Where innovative healthcare technology should be installed? How can referral patterns and the placement of facilities be re-designed to reduce costs whilst ensuring more equitable access to healthcare?

Supply chain design and optimisation: Determining the prioritised improvement initiatives for strengthening vulnerable healthcare supply chains. These include both global (upstream) and local (downstream) supply chains delivering medication, equipment, consumables, etc.

Scenario evaluation for service delivery: Developing and evaluating scenarios for the integration of new healthcare technology into the existing healthcare delivery network.

Decision support technology: Developing bespoke solutions incorporating Operations Research and information technology to support optimal, real-time decision making in healthcare service delivery.

RESEARCH THEME 2: INNOVATION AND TECHNOLOGY FOR IMPROVING DELIVERY AND ACCESS

In this theme we explore how innovation and technology development may contribute to improve healthcare delivery and access to healthcare services across the sub-Saharan continent - specifically focussing on public healthcare systems:

Health Innovation Systems in the developing world: How can we strengthen the capacity of the healthcare innovation system and public health systems to effectively develop, adopt and diffuse new technologies?

Enterprise and industry for healthcare innovation: Innovation for establishing and strengthening healthcare value chains, innovation platforms, technology management, change management and planning.

Validation and feasibility of health technologies: The development and validation of technology, products and the development of business cases and business models for healthcare innovation and adoption within public health systems.

Inclusive innovation and sustainable development: Pro-poor value chains and inclusive innovation system for the improvement of living conditions and creation of employment opportunities for the poor. The development of products, services, processes and business models aimed at resource poor communities.

RESEARCH THEME 3: PUBLIC HEALTH POLICY FOR TECHNOLOGY, INNOVATION AND DEVELOPMENT

Policy development and evaluation: In this theme we explore how Health System Engineering, Innovation and Biomedical Engineering may support and strengthen policy making. This theme also will heavily draw on but also inform studies conducted under Theme 1 and 2.

Public Health Policy for Technology, Innovation and Development: This entails a focus on public health policy and STI policy for Healthcare outcomes. Through this focus area we will consider:

- The role of STI policy instruments and the stimulation of healthcare industries
- Cluster policy and the establishment of industries for healthcare innovation
- Policy making for inclusive and sustainable development

The Monitoring and Evaluation of healthcare interventions where we consider through industrial engineering practices and possibly also through the application of technology how delivery and impact evaluation of healthcare interventions may be strengthened.

Policy making capacity and learning in order to develop capacity in Public Health Systems for Health System Engineering.

Scenario development and evaluation to support policy decisions on the implementation of new technology, new treatment regimes, etc. Rationalisation or redesign of public healthcare delivery systems.

BURSARIES: THE GSK HEALTH SYSTEMS ENGINEERING AND INNOVATION HUB BURSARY SCHEME

What do the bursaries entail?

A number of comprehensive Master's degree bursaries are available that cover the normal costs associated with studying a post-graduate degree. This includes a subsistence allowance, costs associated with conference attendance, project and field work funding and student and tuition fees.

WHAT ARE THE REQUIREMENTS?

Candidates must qualify and enrol for an M.Eng (Industrial Engineering) or an M.Eng (Engineering Management) at the Department of Industrial Engineering at Stellenbosch University and must pursue full-time research at the Health Systems Engineering and Innovation Hub.

HOW DO YOU APPLY?

Visit our website at <http://ie.sun.ac.za/research/health/> for all the necessary information regarding the research group and the bursary application process.