

# Department of Industrial Engineering

## Research Topics ~ 2019

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<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Corne Schutte		<b>E-mail:</b>	<a href="mailto:corne@sun.ac.za">corne@sun.ac.za</a>	
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<b>Field of Research:</b> Enterprise Engineering, Economics, Project- and Risk Management				
<b>General Description (<i>field of research</i>):</b>				
<p>The research area covers the field of enterprise engineering which is a systems engineering focus on the way in which enterprises are constructed. Engineers draw on knowledge throughout their studies to construct the complex adaptive system that is an enterprise. The enterprise engineering cycle focusses from the idea of an enterprise, through to strategic intent, strategy, tactics and how these are implemented through project management with a keen focus on the financials and risk management of the enterprise and the project.</p> <p>The research allows for the hard sciences in engineering on an elemental level of the organisation and project management right up to the softer sciences with a systems engineering focus on strategy, tactics and the organisation of the entities within the enterprise.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Building an Enterprise for the South African Future	X		Refer to the notes below
2	Enterprises as living organisms: Antifragility	X		Refer to the notes below
3	Enterprises as living organisms: Design Structure Matrices	X		Refer to the notes below
4	Enterprises as living organisms: Organisation of Functional Units for Adaptation	X		Refer to the notes below
5	Project Management in a start-up economy	X		Refer to the notes below
6	Risk and feasibility management: Removign the straw that breaks the camel's back	X		Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Funding has not yet been confirmed, but do get in touch with me so that we can discuss any possible funding opportunities.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Dr Louis Louw		<b>E-mail:</b>	<a href="mailto:louisl@sun.ac.za">louisl@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4448	
<b>Field of Research:</b> Enterprise Engineering				
<b>General Description (<i>field of research</i>):</b>				
<b>Engineering Management/ Enterprise Engineering/ Innovation</b>				
Enterprise engineering is a discipline that views the enterprise as a complex system that can be purposefully designed or re-designed. It applies systems theory and engineering techniques to the specification, analysis, design, re-design or improvement, and implementation of an enterprise for its life cycle. It is a multi-disciplinary approach that "takes a broad perspective in synthesizing technical and non-technical aspects of enterprise capability". Innovation also an important driver for enterprise design /re-design, and therefore the management or enablement of innovation is therefore also a key focus.				
<b>The work life and the organisational world is changing very fast. Digitisation and the industrial revolution 4.0 is accelerating these changes.</b> The impact on organisations and humans will be immense. Some new developments are organisations and their ecosystems, digital leadership, digital and agile organisational culture, new work places, robots in factories, big data and new business models, virtual/augmented reality, mobility all around, open innovation via the Internet.				
<b>A key research focus in both these fields will be on the digitalisation of operations and value chains in service environments (such as financial services).</b> Digitization has touched all aspects of businesses, including supply chains and operating models/ business models. Today, new technologies have enabled organizations to transform their existing hybrid structures (combination of paper-based and IT-supported processes) into more flexible, open, agile and collaborative digital models. Digital value chains enable business process automation, organizational flexibility and digital management of corporate assets.				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Digitalisation in value chains - impacts on business models, enterprise design and innovation (various topics in this field can be considered, including student's own topics)	X		Refer to the notes below
2	Block chain - impact and applications in operations and value chains (in service organisations)	X		Refer to the notes below
4	Own topics in the field of enterprise engineering, innovation – can be discussed	X	X	Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Bursaries may be available for these projects, but cannot be confirmed at this stage.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Sara Grobbelaar		<b>E-mail:</b>	<a href="mailto:ssgrobbelaar@sun.ac.za">ssgrobbelaar@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4247	
<b>Field of Research:</b> Engineering Management – Enterprise Engineering				
<b>General Description (<i>field of research</i>):</b>				
<ul style="list-style-type: none"> <li>IoT and Big Data are a great opportunity for developing countries to leapfrog from scientifically disadvantaged nations into technology advanced nations. They may help closing the technology gap and boost scientific progress as they can help build and expand a knowledge society.</li> <li>The Internet of Things can enable the next wave of life-enhancing services across several fundamental sectors of the economy – however use cases for Africa will look very different from those in the developed world...this needs to be developed and explored in our programme.</li> <li>It is the traditional approach to focus innovation programmes on <b>industry verticals</b> such as transport, energy, automotive, manufacturing, construction etc.</li> <li>The IoT co-creation programme will however seek to explore <b>how industry boundaries may be redefined</b> and how industries may be transformed through the IoT revolution</li> </ul>				
The programme will also straddle <b>across application areas within the Department of Industrial Engineering considering application areas in areas such as Health, manufacturing, asset management, and supply chain management.</b>				
Objectives of the Hub are to:				
<ul style="list-style-type: none"> <li>Study and explore locally relevant and efficient capacity building and adapted IoT and Big Data deployment models.</li> <li>Explore use-cases and applications for IoT in Africa towards inclusive development and growth related issues such as productivity, improvement of quality of life, safety, health, education, energy and utility management</li> <li>Development of thought leadership capacity towards shaping and understanding eco-system and platform markets in the African context.</li> <li>Exploratory studies and case studies of the transformative effects of redrawing industry boundaries of the IoT in industry in Africa.</li> <li>Have a particular focus on the design and development of regulations and policies which are adapted for local needs and constraints (e.g. standards, security and ethics).</li> </ul>				
We have a few very exciting projects in collaboration with <b>Vodacom, Aurecon and also the CSIR.</b>				
We have scholarships available for 4-5 students who want to work within the abovementioned themes. <b>Possible internships at partner organisations</b> exist as well as <b>performance incentives.</b>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Exact topics to be explored with the lecturer.	X	X	R80,000 per annum
<b>Notes regarding Funding:</b> N/A				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Mrs Imke de Kock		<b>E-mail:</b>	<a href="mailto:imkedk@sun.ac.za">imkedk@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 9533	
<b>Field of Research:</b> Engineering Management - Sustainable Systems				
<b>General Description (<i>field of research</i>):</b>				
<p>Engineering Management, and more specifically the field of sustainable systems, is a specialised form of management that is concerned with the application of engineering principles to business practice. Engineering management often leads to a career that brings together the technological problem-solving abilities of engineering and the organizational, administrative, and planning abilities of management in order to oversee complex systems from conception to completion. However, the research group focuses on the transition to a more sustainable economy and society, which will place an emphasis on the management of infrastructure and technology, including the planning and design thereof. This, in turn, requires trans-disciplinary, integrated approaches; since our academic and industrial organisations have great expertise in system components, but still lack experience with the management of the 'systems of systems' that constitute our infrastructure and technology at the total societal level. This research group aims to improve the understanding, and develop the associated capacities and capabilities, of how technical, economic, political and other socio-ecological factors interact, particularly in the context of great uncertainties as we embark on the transition.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	The role of technology in the quest for sustainable development: a futures perspective.	X		Refer to the notes below
2	Sustainability transitions in developing country contexts: a system dynamics approach to sustainability in South African context.	X		Refer to the notes below
3	Sustainable innovation, business models and economic performance: a system dynamics approach.	X		Refer to the notes below
4	Sustainable innovation, business models and economic performance: the introduction of a conceptual framework.	X		Refer to the notes below
5	Complex system analyses: Energy and the economy	X		Refer to the notes below
6	Socio-technical transitions to a green economy	X		Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Bursaries may be available for the projects, but will be dealt with on an individual basis.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Mrs Imke de Kock		<b>E-mail:</b>	<a href="mailto:imkedk@sun.ac.za">imkedk@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 9533	
<b>Field of Research:</b> Health Systems Engineering				
<b>General Description (<i>field of research</i>):</b>				
<p>The primary aim of the Health Systems Engineering and Innovation research group is to improve access to primary healthcare in sub-Saharan Africa. The following research themes have been established:</p> <ul style="list-style-type: none"> <li>• <u>Infrastructure and delivery network design</u>: How can we ensure that the right kind of infrastructure and delivery network design is put in place? How can we ensure that this is sustainable?</li> <li>• <u>Operations</u>: How can we improve healthcare delivery operations to increase effectiveness and efficiency with the ultimate goal of improved utilisation of finite resources to improve access?</li> <li>• <u>Technology transfer and innovation</u>: How can we develop and utilise innovations and adopt technologies to reduce costs of, facilitate and improve access to primary healthcare?</li> <li>• <u>Healthcare policy and finance</u>: How can we consider the design of government policies and support mechanisms to improve access to primary healthcare in Southern Africa?</li> <li>• <u>Supply and distribution</u>: How can we improve the effectiveness and efficiency of supply chains and distribution networks to get the necessary resources, medicines and treatments to healthcare facilities and people?</li> </ul>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	An investigation into the normalisation of resource efficiency measures in healthcare facilities.	X		Refer to the notes below
2	The planned extension of the current research projects that focus on National Health Insurance (NHI) and Universal Health Care (UHC) will be aimed at the systemic and healthcare provision network requirements in order to successfully achieve UHC.	X		Refer to the notes below
3	Investigating the status quo of sustainable development within the Healthcare sector: Why is the healthcare sector slow to adopt sustainability practices?	X		Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>• Bursaries for 2018 have not yet been finalised, but the potential for bursaries within the Health Systems Engineering and Innovation Research group certainly does exist.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering	
<b>Lecturer:</b> Mrs Louzanne Bam		<b>E-mail:</b>	<a href="mailto:louzanne@sun.ac.za">louzanne@sun.ac.za</a>
		<b>Tel:</b>	+27 (0)21 808 4089
<b>Field of Research:</b> Health Systems Engineering and Innovation			
<b>General Description (<i>field of research</i>):</b>			
<p>My research focus is on public healthcare systems. Specifically, I am interested in (i) supporting decision-making with regards to the operational and/or strategic management of public healthcare; and (ii) improving the effectiveness of healthcare operations (thus, maximising the impact of the resources that are devoted to healthcare). The majority of my research activity is in quantitative modelling to support improvements in: supply and distribution; operations and infrastructure and delivery network design. Additional research activity is in supporting the development of healthcare policy (primarily through the development and evaluation of alternative scenarios for healthcare provision).</p> <p><b>The topics listed below are merely indicative – I develop a topic in collaboration with each student bearing in mind: (i) their interests and abilities; (ii) the requirements of an MEng; (iii) salient public healthcare challenges; and (iv) research momentum and expertise within the research group.</b></p>			
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>
1	Addressing pharmacovigilance (drug monitoring and safety) challenges, especially in the sub-Saharan African region where adverse reactions to drugs are severely under-reported.	X	Refer to the notes below
2	Leveraging the potential of wearable technology to address healthcare challenges in the sub-Saharan African region—this will build further on research projects that commenced in February 2016.	X	Refer to the notes below
3	Translating the strategic goals of universal healthcare coverage policies into operational objectives—this will build further on research projects that commenced in February 2016.	X	Refer to the notes below
4	Designing a global supply chain for novel medications for multidrug-resistant Tuberculosis.	X	Refer to the notes below
<b>Notes regarding Funding:</b>			
<ul style="list-style-type: none"> <li>Specific bursaries for 2018 have not yet been confirmed, and bursaries are very rarely linked to specific topics. However, several competitive bursaries are typically available within the research group.</li> </ul>			
<b>Prerequisites or Requirements:</b> N/A			

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Sara Grobbelaar		<b>E-mail:</b>	<a href="mailto:ssgrobbelaar@sun.ac.za">ssgrobbelaar@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4247	
<b>Field of Research:</b> Health Systems Engineering				
<b>General Description (<i>field of research</i>):</b>				
<p>The primary aim of the Health Systems Engineering and Innovation research group is to improve access to primary healthcare in sub-Saharan Africa. Professor Grobbelaar focuses specifically on the following research themes in the healthcare context:</p> <p><u>Technology transfer and innovation:</u> How can we develop and utilise innovations and adopt technologies to reduce costs of, facilitate and improve access to primary healthcare?</p> <ul style="list-style-type: none"> <li>• 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?</li> <li>• Enterprise and industry for healthcare innovation: Innovation for establishing and strengthening healthcare value chains, innovation platforms, technology management, change management and planning</li> <li>• 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</li> </ul> <p><u>Supply and distribution:</u> How can we improve the effectiveness and efficiency of supply chains and distribution networks to get the necessary resources, medicines and treatments to healthcare facilities and people? Here we specifically focus on supply chain visibility and the role of innovation and technology platforms to achieve this.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Technology transfer and innovation projects to be discussed with the lecturer	X	X	Refer to the notes below
2	Improving supply network design and management through a demand driven supply chain technology demonstrator	X	X	Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>• Bursaries for 2018 have not yet been finalised, but the potential for bursaries within the Health Systems Engineering and Innovation Research group certainly does exist.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				



<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Sara Grobbelaar		<b>E-mail:</b>	<a href="mailto:ssgrobbelaar@sun.ac.za">ssgrobbelaar@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4247	
<b>Field of Research:</b> Innovation for Inclusive Development (I4ID)				
<b>General Description (<i>field of research</i>):</b>				
<ul style="list-style-type: none"> <li> <b><u>Theme 1 - Innovation and ICTS for development:</u></b>            In this theme we have a number of projects available to contribute to cutting edge thinking on how industries of the future will function with a main aim of driving inclusive development. This includes technology development, analytics and exploratory projects on how industries will be affected, change and adapt to disruptive technologies. We explore what changes and development will hold for the farmer of the future, healthcare for the future, retail of the future and developments in fintech and legaltech.         </li> <li> <b><u>Theme 2 - Technology platforms programme:</u></b>            There exist a wide range of types of innovation platforms, these may include living labs, business incubators, open innovation platforms, rapid prototyping platforms, agricultural or health innovation platforms and university-driven research or innovation platforms. Through this programme we explore the functioning and setup of such infrastructures and how these contribute to how innovation and technology can be developed to improve the delivery and access to goods and services across the sub-Saharan African continent.         </li> <li> <b><u>Theme 3 - Innovation eco-systems and innovation systems in the developing world:</u></b>            In this theme we grapple with the questions of how we can strengthen the capacity of the innovation system to effectively develop, adopt and diffuse new technologies towards providing inclusive growth and development. Here the focus is on developing improved analytical frameworks to analyse and develop strategies for pro-poor value chains and inclusive innovation system;         </li> <li> <b><u>Theme 4 - Validation, feasibility and M&amp;E of innovation for inclusive development:</u></b>            This part of the programme grapples with the development of quantitative and qualitative decision support tools, models and frameworks. With the roll-out of large scale innovation programmes (e.g. a recent roll-out of an m-Health initiative by a large telecoms company to 15000 clinics), effective monitoring and evaluation needs to be done to ensure successful implementation but also to prove business cases in future. This is especially important if companies want to penetrate a public sector vertical or secure funding as real business cases need to be based on hard data; There are also many hidden costs and implementation frameworks need to take these issues into consideration. This will also aim to help companies set up their intervention programmes to ensure that they will be able to evaluate and monitor successes and failures. Possible verticals for studies here include public health systems/mobile technology in agriculture/education etc.         </li> </ul>				
<p>We have scholarships available for 4-5 students who want to work within the abovementioned themes. <b>Possible internships at partner organisations</b> exist as well as performance incentives. We welcome students from other engineering disciplines as innovation projects may also (if the student wish) to include the development of technological innovations – especially for Theme 1 and Theme 2.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Innovation and ICTS for development	X	X	R80,000 per annum
2	Technology platforms programme	X	X	R80,000 per annum

3	Innovation eco-systems and innovation systems in the developing world	X	X	R80,000 per annum
4	Validation, feasibility and M&E of innovation for inclusive development	X	X	R80,000 per annum
<b>Notes regarding Funding:</b> N/A				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Mr Wouter Bam		<b>E-mail:</b>	<a href="mailto:wouterb@sun.ac.za">wouterb@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4085 ( <i>office</i> ) +27 (0)83 271 8612 ( <i>mobile</i> )	
<b>Field of Research:</b> Engineering Management				
<b>General Description (<i>field of research</i>):</b>				
The research group investigates a broad range of topics related to engineering management. These are arranged according to specific themes with related questions that the research seeks to answer:				
<ul style="list-style-type: none"> <li>• <u>Mineral and energy economics</u>: "How can mineral and energy rich developing countries leverage their endowments to provide more value for the citizens of these countries?"</li> <li>• <u>Healthcare systems</u>: "How can Sub-Saharan African countries improve their healthcare systems to more effectively meet the current and future needs of their citizens?"</li> <li>• <u>Finance</u>: "How can the processes that form part of Mergers &amp; Acquisitions and other financial transactions be improved to unlock cost savings and better stakeholder value?"</li> </ul>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Investigating the impact of policies aimed at increasing the downstream processing of minerals in mineral producing countries.	X	X	Refer to the notes below
2	Investigating the key blockages to better performance in the healthcare system in Southern Africa.	X		Refer to the notes below
3	Investigating the possible application of crypto-currencies in facilitating health system improvements.	X		Refer to the notes below
4	Investigating the possible application of crypto-currencies in facilitating financial system improvements.	X		Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>• Bursaries may be available for these projects, but cannot be confirmed at this stage. Once funding is confirmed, there will be an amount of R80,000 + incentives per year available for each of the above topics.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Wynand van Dyk		<b>E-mail:</b>	<a href="mailto:vvandyk@sun.ac.za">vvandyk@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4235	
<b>Field of Research:</b> Risk Management				
<b>General Description (<i>field of research</i>):</b>				
<p>Risk Management is the process of identifying, assessing and controlling unwanted events that could have an impact on the objectives of an organisation. Every decision we make introduces risk and in order to grow and develop as a society, we have to take risks. However, those risks need to be managed in order to ensure the long-term sustainability of organisations and society at large. The recently published sustainable development goals provide a handy framework for long-term sustainability. This field of research is aimed at understanding what makes certain organisations more resilient/sustainable than others and to understand why certain projects are more resilient than others.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	The link between risk management and resilient organisations.	X		Refer to the notes below
2	The application of Resilience Engineering concepts in the Mining domain.	X		Refer to the notes below
3	Project risk management:- comparisons & lessons learnt between large and SME mining companies	X		Refer to the notes below
4	The link between the sustainable development goals and risk management	X		Refer to the notes below
5	Student may develop or choose his/her own topic in the field of Risk Management and/or Organisational Resilience	X		Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Bursaries may be available for these projects, but cannot be confirmed at this stage. Once funding is confirmed, there will be an amount of R80,000 + incentives available for each of the above topics.</li> </ul>				
<b>Prerequisites or Requirements:</b> BEng undergraduate				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Dimitri Dimitrov		<b>E-mail:</b>	<a href="mailto:dimitrov@sun.ac.za">dimitrov@sun.ac.za</a>	
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<b>Field of Research:</b> Smart Sustainable Advanced Manufacturing				
<b>General Description (<i>field of research</i>):</b>				
<p>The sustainability of manufacturing in general and of smart (intelligent) advanced manufacturing in particular is a hot topic in manufacturing research on the global stage. The most important characteristic hereby is the <u>digital</u> base, reflected in the almost entire field of production engineering, i.e.</p> <ul style="list-style-type: none"> <li>• Computer modelling, analysis and simulation for design purposes (CAD)</li> <li>• Computer aided process planning (CAPP)</li> <li>• Computer aided manufacturing (CAM), including CNC-Machining</li> <li>• Computer aided engineering (CAE)</li> <li>• Computer aided tolerancing (CAT)</li> <li>• Computer aided quality control (CAQ) etc., culminating in</li> <li>• Computer integrated manufacturing (CIM).</li> </ul> <p>Furthermore, the digitalisation led to the emerging of a completely new class of manufacturing technologies – the Additive Manufacturing - in late 90, followed by the 4<sup>th</sup> industrial revolution (Industrie 4.0) or the Internet of Things (IoT) at the beginning of the new century. Latest developments in this field are leading to new frontiers – the Biologicalisation in Manufacturing. That means the <i>“use and integration of biological and bio-inspired principles, materials, functions, structures and resources for intelligent and sustainable manufacturing technologies and systems with the aim of achieving their full potential”</i>.</p> <p>Developing further existing research results and avenues and taking in account the latest trends in manufacturing engineering as outlined above a number of interesting research topics are formulated below.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Recourse efficient production of high added value titanium components	X	X	R70,000 - R120,000
2	Selective laser melting – process modelling	X	X	R70,000 - R120,000
3	Additive manufacturing in tooling for sheet metal forming	X	X	TBC
4	Quality management for additive manufacturing	X	X	TBC
5	Re-manufacturing of End-of-Life (EoL) components using hybrid additive/subtractive processes	X	X	TBC
6	Biologicalisation in manufacturing processes	X	X	TBC
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>• For certain topics, as shown above, funding in form of bursaries is available based on running projects. The other topics are related to projects which are in development phase and funding needs still to be obtained. Prospective students are encouraged to contact Prof Dimitrov for detailed discussion.</li> </ul>				

**Prerequisites or Requirements:**

- Enthusiasm and keen interest in manufacturing.

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
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		<b>Tel:</b>	+27 (0)21 808 9531	
<b>Field of Research:</b> Smart Sustainable Advanced Manufacturing				
<b>General Description (<i>field of research</i>):</b> Developing the science, capabilities and commercial opportunities to develop and support local manufacturing suppliers.				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Local Manufacturing Supplier Development Strategies	X	X	R70,000 – R120,000
2	Smart Production Systems	X	X	R70,000 – R120,000
3	Resource Efficient Process Chains	X	X	R70,000 – R120,000
4	Additive Manufacturing and Applications	X	X	R70,000 – R120,000
5	Smart Materials	X		R70,000 – R80,000
6	Intelligent Bio-Medical Implants	X		R70,000 – R80,000
<b>Notes regarding Funding:</b> <ul style="list-style-type: none"> <li>• Topic to be finalised in consultation with the student based on his/her interests &amp; background. Students are invited to talk to Prof Tiaan Oosthuizen to trigger the process of formalising a topic. Students are, however, requested to prepare for such a meeting by thinking in detail beforehand about which area within manufacturing they would like to pursue their studies. A bursary will be made available only if the merit of the topic and student combination warrants it.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Andre van der Merwe		<b>E-mail:</b>	<a href="mailto:andrevdm@sun.ac.za">andrevdm@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)73 131 3382 ( <i>mobile</i> )	
<b>Field of Research:</b> Resource Efficiency Engineering Management				
<b>General Description (<i>field of research</i>):</b>				
<p>We focus on resource efficiency in the supply chains of medical and aerospace products produced by Additive Manufacturing (AM). AM is an emerging technology with many challenges in its Technology- and Commercial Readiness.</p> <p>Our research group aims to improve South Africa's competitiveness in the global market with respect to mass customised medical and aerospace devices. The initial focus is on medical devices. Medical training models are used for basic education through to advanced levels, but currently real animals are sacrificed in dissection training to replace human specimens. We aim to replace real animals with polymer specimens.</p> <p>Our collaboration with NSPCA commits our resources to animal welfare. Several requirements in the medical field are address by using mass customised manufacturing for dissection models, pre-operative models, prostheses, implants, and orthotics. Ongoing collaboration with Centre of Rapid Prototyping and Manufacturing (CRPM) in Bloemfontein has proven success especially in the Maxillo facial treatment of cancer patients.</p> <p>Your Masters or PhD in Engineering Management will focus on using systems engineering to develop the supply chain for medical devices. You will apply value chains on each product's life cycle to determine risk in terms of quality, cost, time, and flexibility. Your focus will be on commercial readiness.</p> <p>Additive Manufacturing (AM) is fundamentally flexible and lends itself to mass-customisation. Our focus is to commercialise mass-customisation using AM.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Prosthesis/ implants/ orthotics: Patient specific prosthesis are manufactured in several bio-compatible materials. Digital manufacturing process chains enable us to design and manufacture a customised implant for every user.	X	X	Refer to the notes below
2	Pre-operative models: Pre-operative models give surgeons and suppliers the opportunity to plan the procedure outside the operating theatre, before the procedure. Advanced scanning techniques including CT and MRI provide digital imaging, which is converted to 3D printing data for manufacturing.	X	X	Refer to the notes below
3	Develop a supply chain business model for dissection models: Use for basic medical training as well as customised training in patient specific cases using Additive Manufacturing. Use Technology Readiness Levels (TRL) and Commercial Readiness Index (CRI) to benchmark your model for venture capitalists.	X	X	Refer to the notes below
4	SCOR ( <i>Supply Chain Operations Reference</i> ) for Additive Manufacturing (AM). Few training programs on how to manage AM exists. Develop a tacit knowledge transfer management framework for AM. Propose a SCOR for AM based on the outcome of your framework.	X	X	Refer to the notes below



5	Manufacturing for mass customisation: Medical training models are manufactured using a range of techniques including 3D printing, laser cusing, selective laser melting, casting, hand forming, machining forming, molding, injection molding, CNC milling.	X	X	Refer to the notes below
6	Value chain analysis for accurate pricing: Comprehensive value stream analysis is conducted for each product, whether one off or multiples off. Our team of Industrial engineers have automated this process in order that pricing is available before every procedure. Activity Costing is applied.	X	X	Refer to the notes below
7	Life cycle assessment for commercial risk: Product life cycle assessment covers the manufacturing technique and supports the product specific life cycle planning. Each product is backed up by a complete life cycle assessment plan, to inform the user of the risks.	X	X	Refer to the notes below
8	Medical Systems Engineering (Mediclinic): We focus on the gap between clinical prognoses and systems engineering in healthcare. The outcome focus is cost reduction in healthcare (e.g. reduction in theatre time as medical funds now pay per procedure, and not for time in theatre). The project focus is on pre-operative planning and patient specific medical models using 3D printing.	X	X	Refer to the notes below
9	Human capital development is the main output goal of this program. The commercialisation of Additive Manufacturing (AM) technology is used as the enabling platform. Additive Manufacturing is a new technology that is being established worldwide and is still in its infant shoes in South Africa. Rapid Prototyping has been a topic of research and DST funding for many years, but mass-customised production facilities have not been commercialised economically yet.	X	X	Refer to the notes below

**Notes regarding Funding:**

- Funding is available as a bursary, and for international travel. Students who would like to apply must be willing to travel and spend time in Germany, United Kingdom, Brasil, China or India. Bursaries will cover class fees, and will contribute towards residence fees. Bursaries are performance based, and performance is evaluated on publication and progress.

**Prerequisites or Requirements:** N/A

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Dr Stephen Matope		<b>E-mail:</b>	<a href="mailto:smatope@sun.ac.za">smatope@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)73 157 0020 ( <i>mobile</i> )	
<b>Field of Research:</b> Manufacturing				
<b>General Description (<i>field of research</i>):</b>				
<p>Manufacturing as an engineering field focuses on the creation of wealth by processing raw materials in order to produce value added products for a ready market. Manufacturing can either be on a micro-scale or macro-scale depending on the size of the products being produced, hence the terms micro-manufacturing or macro-manufacturing. Manufacturing processes include metal forming, machining operations and rapid product development. During manufacturing, material handling operations are also taken into consideration. Students can embark on manufacturing related researches in their own field of interest with the aim of innovatively producing new and better products. In some cases students may decide to develop new production tooling aimed at shortening production lead times or reducing production costs.</p> <p>For prospective Master's and PhD students in manufacturing, they should first identify a need or a research gap in the area of their interest. A thorough literature review would be necessary to justify the existence of a knowledge gap; once this is done, the candidate can approach the lecturer with a brief research proposal. A discussion would then follow between the student and the lecturer, and when an agreement is reached the research can then be started.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Application of micro-material handling techniques in micro-manufacturing	x	X	Refer to the notes below
2	Application of additive manufacturing in production tooling	X	X	Refer to the notes below
3	Continuous improvement framework for specific companies	X	X	Refer to the notes below
4	Development of robotic prosthetic limbs	X	X	Refer to the notes below
5	Creating Shared Value through Manufacturing	X	X	Refer to the notes below
6	Management of residual stresses in products made by selective laser melting	X	X	Refer to the notes below
7	Cutting performance in machining of titanium alloys	X	X	Refer to the notes below

**Notes regarding Funding:**

- Bursaries are available, but are performance based. Performance is evaluated on publication and progress in the research.

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**Prerequisites or Requirements:** N/A

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Dr Theuns Dirkse van Schalkwyk		<b>E-mail:</b>	<a href="mailto:theuns@sun.ac.za">theuns@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 2189	
<b>Field of Research:</b> Manufacturing				
<b>General Description (<i>field of research</i>):</b>  Management and optimising of manufacturing systems. Sub-fields include micro-manufacturing, models of manufacturing competitiveness, process control, process optimising and process design. Optimising, modeling and simulation are done in R, while visual aspects are represented in Javascript.				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Removing barriers to design	X	X	See notes
2	Manufacturing competitiveness models	X	X	See notes
<b>Notes regarding Funding:</b>  <ul style="list-style-type: none"> <li>Available. Amount available to be discussed with supervisor.</li> </ul>				
<b>Prerequisites or Requirements:</b>  <ul style="list-style-type: none"> <li>Using and Programming in R</li> </ul>				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Dr Joubert van Eeden		<b>E-mail:</b>	<a href="mailto:jveeden@sun.ac.za">jveeden@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 3970	
<b>Field of Research:</b> Supply Chain Management				
<b>General Description (<i>field of research</i>):</b>				
<p>"A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer. Supply chain activities involve the transformation of natural resources, raw materials, and components into a finished product that is delivered to the end customer. " - Mentzer et al. (2001)</p> <p>For engineers from all disciplines, supply chain management describes involvement in design and management of these highly complex systems in order to create value for all participants in the complete chain. This includes processes from product design, to sourcing, manufacturing, distribution and customer service, network design, optimisation, information sharing, detailed and long term planning, etc.</p> <p>The list below are representing key fields of interest for the lecturer. Own topics or discussions about industry topics (the lecturer know about) within these fields would be welcomed.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Develop medium term planning frameworks to incorporate extended inventory visibility across organisations throughout the supply chain network.	X		TBF
2	Developing industry <b>performance measurement</b> frameworks to ensure benchmarking and improved global industry competitiveness.	X		TBF
3	A framework to realign supply chains during a process of <b>waste reduction</b> . Various topics around bringing supply and demand closer together through logistics hubs and productive neighbourhoods, eliminating choice and overproduction, increasing reuse and decarbonising the supply chain in general. Taking flow modelling towards the circular economy.	X		TBF
4	<b>Food and water supply chain security issues.</b> Infrastructure, policy and flow modeling to support security programs.	X		TBF
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Industry funding are available for some projects related to specific industries</li> </ul>				
<b>Prerequisites or Requirements:</b> BEng (Industrial) undergraduate				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Dr Joubert van Eeden		<b>E-mail:</b>	<a href="mailto:jveeden@sun.ac.za">jveeden@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 3970	
<b>Field of Research:</b> Macrologistics Engineering				
<b>General Description (<i>field of research</i>):</b>				
<p>Macrologistics is the scoping and prioritizing of national policy, projects and macrologistics performance measurement. Macrologistics involves a complex group of interrelated economic, infrastructure and organizational systems that could be analyzed and improved using a systems engineering approach. This has been done to some extent within the Logistics Management domain through modelling sub-systems and research in micrologistics, but a vast number of research opportunities exist from the systems engineering perspective. This opportunity spans across engineering disciplines with applications on both detail level but also a strategic or even national level. These include but are not limited to the supply chain in general, logistics, systems modelling, operational research, financing and costing, infrastructure development, equipment design and policy environments with large scale benefits for a South Africa in need of growth and development.</p> <p>Macrologistics improvement is possible through a multidisciplinary hierarchical system, i.e. on the first level by avoiding unnecessary inputs (macroeconomics), on the second level by avoiding unnecessary activity (industrial engineering and logistics) and on the third level by improving the efficiency of infrastructure (civil engineering) and equipment (mechanical engineering) used in logistics.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Various topics possible related to freight intermodal facilities (i.e. Design, location, public-private-partnerships, etc.).	X		TBF
2	Developing a costing framework and decision support system for placement of container packing and unpacking facilities at either back-of-port or inland dry-ports.	X		TBF
3	Develop a freight flow model layer to facilitate the incorporation of regional and national DC's into long term national FMCG commodity modelling.	X		TBF
4	Develop a modelling framework to accurately model and forecast the national movement of empty containers.	X		TBF
5	Develop a framework to trace container movements through national freight systems in order to facilitate and manage freight owners' delivery expectations.	X		TBF
6	A framework for the continuous macroeconomic impact measurement of delays, stoppages and bottlenecks caused by logistics infrastructure and institutional systems.	X		TBF
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Several funding alternatives are in process and will be advised on with specific interested students</li> </ul>				

**Prerequisites or Requirements:**

- BEng from all disciplines are welcome to apply.

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Mr Konrad von Leipzig		<b>E-mail:</b>	<a href="mailto:kvl@sun.ac.za">kvl@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 9107	
<b>Field of Research:</b> Financial and Supply Chain Management				
<b>General Description (<i>field of research</i>):</b>				
<p>Typical topics look at the impacts of gamification (serious gaming), Industry 4.0 &amp; social media on SCM. We are actively involved in research on the impact of real time data (Internet of things, Industry 4.0, smart factories) on the supply chain and the requirements this poses on the internal processes and logistics of companies. Here we are busy negotiating further co-operation between ourselves, two leading Universities in Germany, and the motor industry to develop tools for use in the manufacturing of new models in SA planned to come on-line in 2018.</p> <p>We are also looking at the impact social media has on production and service delivery (you might remember the discussions/arguments regarding the dress being blue and white or gold and white, and the increase in sales of 340% this had) and how to harness this in improving the bottom line.</p> <p>A further research branch is the use of gamification (you might want to look under "serious gaming") to not only improve the understanding of processes, but also looking at the use of games and game elements in the education and training of our workforce (and possibly higher education).</p> <p>Lastly, we are looking at supply chain management in general, trying to use whatever tools are available to improve the efficiencies within the chain, but with a special focus on "the last mile of delivery". This is especially important in Africa, where the deliveries to cities or huge malls are relatively easy, but demand in rural or sparsely populated areas is rather more difficult and expensive to satisfy. With more and more companies looking at expanding into countries to the north of us this becomes a critical aspect. This implies that one needs to understand the market (where no or little information regarding income levels, sales, and even customers is available) and also look at different delivery mechanisms, from an own fleet delivery over outsourcing to 3rd parties (3PL or even 4PL) or making use of a "bakkie brigade" to using country and area specific delivery mechanisms. In this regard, there is an existing co-operation agreement with a local consulting company where students get practical exposure to some of those countries and the difficulties they are facing.</p> <p>As with most other things in life, companies (and individuals) are always looking at the impact any intervention has on the bottom line. So any topic looking at financial feasibility will always be considered.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Develop a gaming prototype showing the impact gamification can have on the shop floor (or the service delivery process).	X		Refer to the notes below
2	Develop a framework to calculate the "cost to serve" of customers in rural areas of Africa.	X		Refer to the notes below
3	Analyse the impact of, and develop an implementation strategy for Industry 4.0, to enhance productivity in the automotive sector.	X		Refer to the notes below
4	Analyse the impacts of, and how to harness the full potential of social media on the bottom line.	X		Refer to the notes below



5	Develop a framework and prototype for how games and gamification can be used to improve or enhance tertiary education.	X		Refer to the notes below
6	<p>Internships / Industry projects: I have a number of opportunities with (local) companies who are interested in sponsoring a M student to help with the necessary theory in "improvement projects". These range from distribution networks in Africa, over rural development in the agricultural sector, to specific improvements with a public transport provider (Golden Arrows).</p> <p>This is the ideal opportunity to obtain some practical experience while doing relevant research.</p>	X		tbc
<p><b>Notes regarding Funding:</b></p> <ul style="list-style-type: none"> <li>Funding has not yet been confirmed, but do get in touch with me so that we can discuss any possible funding opportunities.</li> </ul>				
<p><b>Prerequisites or Requirements:</b> N/A</p>				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Dr Louis Louw		<b>E-mail:</b>	<a href="mailto:louisl@sun.ac.za">louisl@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4448	
<b>Field of Research:</b> Operations & Supply Chain Management				
<b>General Description (<i>field of research</i>):</b>				
<b>Operations &amp; Supply Chain management</b>				
Operations & Supply Chain Management focuses on process excellence from both intra-organizational and inter-organizational points of view. A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer. Supply chain management manages the flow of goods, and information and services, in order to deliver maximum value to the consumer, while minimizing the costs of the flow (inter-organizational). Operations management is responsible for supplying the product or service of the organization and managing the conversion or transformation process that converts inputs into outputs (intra-organizational).				
<b>The work life and the organisational world is changing very fast. Digitisation and the industrial revolution 4.0 is accelerating these changes.</b> The impact on organisations and humans will be immense. Some new developments are organisations and their ecosystems, digital leadership, digital and agile organisational culture, new work places, robots in factories, big data and new business models, virtual/augmented reality, mobility all around, open innovation via the Internet.				
<b>A key research focus in both these fields will be on the digitalisation of operations, supply chains, and value chains in both the manufacturing, retail, and service environments (such as financial services).</b> Digitization has touched all aspects of businesses, including supply chains and operating models. Today, new technologies have enabled organizations to transform their existing hybrid supply chain structures (combination of paper-based and IT-supported processes) into more flexible, open, agile and collaborative digital models. Digital supply chains enable business process automation, organizational flexibility and digital management of corporate assets.				
<b>As part of this research, the opportunity exist for selected students to participate in a double degree Masters programme with Reutlingen University in Germany.</b> Students will spend 5 months in Germany participating in two modules on digitalisation, while continuing to work on their Masters thesis. Students who successfully complete the programme will receive a double Masters degree, both from Stellenbosch University as well as Reutlingen University (which will be internationally recognised).				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Digitalisation in operations and supply chain management (various topics in this field can be considered, including student's own topics - such as topics related smart production systems, smart supply chains, automation	X	X	Refer to the notes below
2	Excellence for Li-ion Batteries Innovative End of Life Management - Design of efficient reverse/ closed loop supply chains for lithium-ion batteries.	X		R80 - R100 000 per year for 2 students for 2 years (potentially - still to be confirmed)

3	Block chain - impact and applications in operations and supply chain (in both manufacturing and service organisations)	X		Refer to the notes below
4	Own topics in the field of enterprise engineering, innovation, operations and supply chain management – can be discussed	X	X	Refer to the notes below
<p><b>Notes regarding Funding:</b></p> <ul style="list-style-type: none"> <li>Bursaries may be available for these projects, but cannot be confirmed at this stage. For students participating in the double degree masters programme with Reutlingen in Germany, travel and accommodation cost will be covered for the 5 months.</li> </ul>				
<p><b>Prerequisites or Requirements:</b> N/A</p>				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Dr Wyhan Jooste		<b>E-mail:</b>	<a href="mailto:wyhan@sun.ac.za">wyhan@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4234	
<b>Field of Research:</b> Physical Asset Management				
<b>General Description (<i>field of research</i>):</b>				
<p>The Asset Care Research Group (ACRG) provides an opportunity for prospective postgraduates to specialise in physical asset management (AM) by studying for a Masters (or Doctoral) degree in Engineering Management or Industrial Engineering.</p> <p>AM is about the systematic and coordinated activities through which organisations optimally and sustainably manage their assets over their respective life cycles. AM is not only about doing things to assets, but more so about extracting value from the assets to achieve the organisation's business objectives. AM is therefore multifaceted considering the strategic, tactical and operational aspects of an organisation's portfolio of assets. AM has become considerably important in the modern economy. Higher performance demands are placed on physical assets, such as equipment and infrastructure, while there are business and regulatory pressures to lower costs, risks and operate assets in a health conscious, safe, environmentally and socially sustainable manner. To support industry in managing physical assets these challenges have led to the release of the ISO 55000 suite of standards and its predecessor PAS 55. Criticism of both these standards is that they provide guidance about "what" to do, but not about "how" to execute the guidelines. Therefore, there is a need to pioneer methods, processes and technology applications to support AM activities horizontally across organisational activities and to support management vertically throughout the organisational hierarchy.</p> <p>The ACRG was founded in 2011. Since its inception the ACRG has established itself as a premium research destination for postgraduate AM thought leadership with a comprehensive portfolio of research outputs and activities. The MEng and PhD programmes with specialisation in Physical Asset Management are specifically aimed at thought leading individuals who wish to distinguish themselves amongst their peers as pioneers of and contributors towards the global AM body of knowledge.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	<p>Topics are determined in consultation with students and should ideally be based on the student's specific asset management interests. Students are encouraged to arrange a discussion for exploring topic ideas. During such discussions industry collaboration through the ACRG's vast industry network is also explored. Students are encouraged to come prepared by conducting some preliminary screening of possible ideas to ensure a productive discussion. Refer to the <a href="#">ACRG's webpage</a> for examples of previous research.</p>	X	X	Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Bursaries may be available for these projects, but cannot be confirmed at this stage.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Neels Fourie		<b>E-mail:</b>	<a href="mailto:cjf@sun.ac.za">cjf@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4237	
<b>Field of Research:</b> The PRASA Engineering Research Chair				
<b>General Description (<i>field of research</i>):</b>				
<p>The PRASA (Passenger Rail Agency of South Africa) Engineering Research Chair is a multi-engineering discipline research group strategically positioned in the Department of Industrial Engineering to research and solve railway related engineering problems. Because of its unique position in the Faculty, the Chair also supports research from other departments, making collaboration between engineering departments possible.</p> <p>The Research Chair initiates and executes research into aspects of Maintenance Management and applicable Engineering Management principles best suited to the needs of PRASA. You will join an established team of full time Research Engineers and postgraduate students who collaboratively work on improving one of the most important sectors in South Africa. Research areas include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Energy Management</li> <li>• Reliability Engineering</li> <li>• Change Management</li> <li>• Big Data Analysis</li> <li>• Asset Use Optimisation</li> <li>• Simulation</li> <li>• Facility layout designs</li> <li>• Maintenance Management</li> <li>• Process Improvement</li> <li>• Artificial Intelligence in rail</li> <li>• Smart mobility solutions</li> </ul>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	The utilisation of smart cities to create smart rail transport experiences.	X		Refer to notes below
2	A decision model for a robust time table for passenger rail rolling stock to improve availability of trains.	X		Refer to notes below
3	Investigate the impact of maintenance strategies on the reliability of a Railway System.	X		Refer to notes below
4	The role of passenger rail in rural small-town economic revitalization and regeneration.	X		Refer to notes below
5	The application of change management strategies in a rail environment to improve organisational effectiveness.	X		Refer to notes below
6	A supply chain decision model for the allocation of vandalised rolling stock.	X		Refer to notes below

Students can also suggest own topics that are relevant to the rail environment in South Africa.			Refer to notes below
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**Notes regarding Funding:**

- Funding is available, but will be confirmed at a later stage.

**Prerequisites or Requirements:**

- Conforms with the general departmental rules for admission to postgraduate study.

<b>Faculty:</b> Faculty of Engineering	<b>Department:</b> Industrial Engineering	
<b>Lecturer:</b> Dr Danie Lötter	<b>E-mail:</b>	<a href="mailto:danielotter@sun.ac.za">danielotter@sun.ac.za</a>
	<b>Tel:</b>	+27 (0)21 808 3733
<b>Field of Research:</b> Operations Research		
<p><b>General Description (<i>field of research</i>):</b></p> <p>I am one of four lecturers in the Stellenbosch Unit for Operations Research in Engineering (SUnORE). Operations research is a multidisciplinary field which typically involves solving decision making problems which cut across several disciplines. My expertise in the field of operations research include, multi-objective optimisation, scheduling, vehicle routing problems, linear programming problems and transportation problems.</p> <p>I currently do not have a list of research topics to choose from. I believe that the student should rather find a field of study which (s)he find appealing after which the student and myself can formulate a topic.</p>		
<p><b>Notes regarding Funding:</b></p> <ul style="list-style-type: none"> <li>I currently do not have any funding available for postgraduate students. I am, however, more than willing to provide support in terms of writing recommendation letters etc.</li> </ul>		
<p><b>Prerequisites or Requirements:</b></p> <ul style="list-style-type: none"> <li>Students should have a good background of what operations research is for e.g. by having completed the two undergraduate courses (on third year and fourth year level), which we offer at the department of Industrial Engineering at Stellenbosch University.</li> </ul>		

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Mr Thorsten Schmidt-Dumont		<b>E-mail:</b>	<a href="mailto:thorstens@sun.ac.za">thorstens@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4233	
<b>Field of Research:</b> Operations research and Decision Support				
<b>General Description (<i>field of research</i>):</b>				
<p>Application of various operations research techniques, including machine learning (including but not limited to reinforcement learning), and various techniques pertaining to the solution to real-world optimisation problems, taking into account the complex nature of such problems. This optimisation is typically performed in the context of building so-called decision support systems, aimed at helping non-mathematically inclined users make effective decisions based on the underlying models built into the system. The application of such techniques to a wide variety of contexts, including traffic flow optimisation, facility location, and selection and scheduling problems may be explored.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Topic to be finalised in consultation with the student based on his/her specific interests and abilities	X		Refer to the notes below
<b>Notes regarding Funding:</b>				
<ul style="list-style-type: none"> <li>Funding opportunities may be discussed with the supervisor, but cannot be confirmed at this stage.</li> </ul>				
<b>Prerequisites or Requirements:</b>				
<ul style="list-style-type: none"> <li>N/A</li> </ul>				



<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Ms Christa de Kock		<b>E-mail:</b>	<a href="mailto:christadk@sun.ac.za">christadk@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)79 545 4304	
<b>Field of Research:</b> Computer Simulation Modelling, Optimisation, Decision-Support				
<b>General Description (<i>field of research</i>):</b> Computer simulation modelling, mostly agent-based modelling, and/or other software is utilised to analyse complex systems taking into consideration the unpredictable, highly dynamic real-world environments in which these systems exist. This is typically in the context of building decision-support systems to aid in better understanding of systems, or finding optimal/near optimal solutions in terms of system configuration and parameter selection. The application of computer simulation modelling, optimisation and decision support within the humanitarian context, such as forced migration and disease modelling, may be explored.				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Topic to be finalised in consultation with the student based on his/her interests and abilities.	X		Refer to the notes below
<b>Notes regarding Funding:</b> <ul style="list-style-type: none"> <li>Bursaries may be available for these projects, but cannot be confirmed at this stage.</li> </ul>				
<b>Prerequisites or Requirements:</b> N/A				

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof James Bekker		<b>E-mail:</b>	<a href="mailto:jb2@sun.ac.za">jb2@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4951	
<b>Field of Research:</b> Systems Modelling, Operations Research, and Decision Support				
<b>General Description (<i>field of research</i>):</b>				
<p>We study complex, stochastic dynamic systems with computer simulation with the aim of optimising system performance. Such systems include manufacturing plants, food processing plants, mining operations and services in hospitals, medical laboratories and commercial banks. We also analyse systems for Big Data potential and application of Big Data for business intelligence. The research strategy followed is to identify a suitable topic with a well-defined scope via preliminary research. Therefore, no specific topics are currently available.</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Balancing exploration and exploitation of metaheuristics when doing multi-objective optimisation.	X	X	Refer to the notes below
2	Gamification and simulation teaching.	X	X	Refer to the notes below
3	Solving the dynamic mission-ready problem with simulation and metaheuristics	X	X	Refer to the notes below
4	Topics in Big Data Analytics (these topics include the use of machine learning and other techniques): 1) Development of a Big Data demonstrator; 2) Customer super-prolonging using big data sets; 3) Targeted marketing using big data sets; 4) Customer-relationship management and business partnerships using big data sets.	X	X	Refer to the notes below
5	Topics in simulation-optimisation: Current work includes development of a multi-objective optimisation (MOO) suite for Tecnomatix. Multi-objective simulation optimisation (MOSO) is a fairly young research field, and it covers many challenges for the student who wants to work in an exciting domain.	X	X	Refer to the notes below
6	I met with engineers working on the Square Kilometre Array project. They formulated five projects, with titles 1) SKA1: Failure Mode Performance Optimisation 2) Human Knowledge Acquisition 3) Observation Scheduling 4) SKASA Telescope Operational Optimisation Audit 5) UV Coverage Metric	X	X	Refer to the notes below

The topic titles are somewhat cryptic, but I have detailed descriptions available which the interested student may request from me. These topics are very interesting and challenging. Note that the SKA office is in Pinelands, Cape Town, not in the Karoo as many people believe.			
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**Notes regarding Funding:**

- Funding is available, but details will be confirmed at a later stage.

**Prerequisites or Requirements:** N/A

<b>Faculty:</b> Faculty of Engineering		<b>Department:</b> Industrial Engineering		
<b>Lecturer:</b> Prof Jan van Vuuren		<b>E-mail:</b>	<a href="mailto:vuuren@sun.ac.za">vuuren@sun.ac.za</a>	
		<b>Tel:</b>	+27 (0)21 808 4244	
<b>Field of Research:</b> Operations Research and Decision Support				
<b>General Description (<i>field of research</i>):</b>				
<p>The Stellenbosch Unit for Operations Research in Engineering (SUnORE) focuses its research on the design and implementation of mathematical and statistical modelling techniques in support of effective decision-making in industry. In order to achieve this, system responses to changes in their input parameters are considered in the form of sensitivity analyses and scenario planning. This knowledge of the system responses is then used to determine suitable trade-off solutions that may be recommended as desirable courses of action in complex management problems. The modelling techniques typically used derive from the fields of linear, integer, nonlinear and dynamic programming, multi-objective optimisation, utility theory, Markov chains, queuing theory, inventory theory, game theory, graph theory, simulation and forecasting. This modelling approach finds natural application in areas such as the banking and insurance sector, lean manufacturing, efficient retailing and warehousing, responsible natural resource management, the formulation of robust agricultural practices, military decision support and various instances of streamlining within the public sector (e.g. energy planning and urban traffic congestion alleviation).</p>				
<b>List of Research Topics:</b>		<b>MEng</b>	<b>PhD</b>	<b>Funding</b>
1	Topic to be finalised in consultation with the student, tailored to his/her interests & background. Students are invited to talk to Prof JH van Vuuren to trigger the process of formalising a topic. Students are, however, requested to prepare for such a meeting by thinking in detail beforehand about which area within operations research they would like to pursue masters studies. A bursary will be made available only if the merit of the topic and student combination warrants it.	X		Refer to the notes below
2	<p>Examples of recent masters topics, just to provide the reader with an idea of the kind of research conducted in the SUnORE group (in each case the area of the study is provided in parentheses):</p> <ul style="list-style-type: none"> <li>a) Spatial analysis of road accident causes within a machine learning paradigm (Machine learning)</li> <li>b) A hyper-heuristic approach towards artificial neural network training (Machine learning)</li> <li>c) Graph-based semi-supervised learning in pursuit of disease gene identification (Machine Learning)</li> <li>d) The emergence of cooperation in spatial evolutionary games played on graphs (Game theory)</li> <li>e) Decision support for the effective management of a drive-through franchise (Agent-based Simulation)</li> <li>f) Mathematical models for sustainable wealth redistribution (Differential equations)</li> <li>g) A framework for mitigating bias in group decision making (Behavioural Operations Research)</li> </ul>	X		

3	<p>Examples of recent doctoral topics, just to provide the reader with an idea of the kind of research conducted in the SUnORE group (in each case the area of the study is provided in parentheses):</p> <p>a) A tiered-facility vehicle routing problem with global cross-docking (Integer Programming)</p> <p>b) Generator maintenance scheduling based on the expected capability of satisfying energy demand (Integer Programming)</p> <p>c) Self-organisation in traffic signal control algorithms (Agent-based Simulation)</p> <p>d) Metaheuristic solution of the two-dimensional strip packing problem (Combinatorial Optimisation)</p> <p>e) Evolutionary feasibility strategies in constraint programming (Machine Learning)</p> <p>f) Reinforcement learning for the control of traffic flow on highways (Machine Learning)</p> <p>g) Model-based decision support for subjective selection problems with large decision spaces (Multi-criteria Decision Making)</p>		X	
<p><b>Notes regarding Funding:</b></p> <ul style="list-style-type: none"> <li>Bursaries may be available, but cannot be confirmed at this stage. Students are welcome to discuss funding with Prof van Vuuren on an <i>ad hoc</i> basis.</li> </ul>				
<p><b>Prerequisites or Requirements:</b> N/A</p>				