INDUSTRIAL ENGINEERING
Stellenbosch University

**MEng PUBLIC DEFENCE: DECEMBER 2015 GRADUATION**
**DEPARTMENT INDUSTRIAL ENGINEERING**
**29 & 30 October 2015**

# STIAS: 29 October 2015

*Van Niekerk Smit-Jacobus Bosman*
*Chairperson: Prof JH van Vuuren*

| **Ouditorium 2** | 08:30 – 09:00 | **Breakaway 1** | 09:10 – 09:40 |
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| **Titel** | Agriculture sector implications of a green economy transition in the Western Cape Province of South Africa: A system dynamics modelling approach to food crop production | | | | |
| **Abstract** | *The Western Cape Government has introduced a green economy framework, called "Green is Smart", in order to create a more sustainable economy. This framework aims to implement more sustainable farming practices when producing food crops. This will lead to benefits for the environment, while impacting food crop production and requiring additional financial investment from various stakeholders. In order to fully comprehend the problem at hand and to better understand this transition, System Dynamics Modelling is used to model the food crop production system of the Western Cape. The research also provides recommendations in order to better manage this green economy transition within the food crop production sector.* | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof AC Brent | **Co-studyleader** | Dr J Musango |

*Greyling Berno Theo*
*Chairperson: Prof CSL Schutte*

| **Ouditorium 2** | 09:10 – 09:40 | **Breakaway 2** | 09:50 – 10:20 |
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| **Titel** | Applying process mining to analyse business process performance in the physical asset management environment | | | | |
| **Abstract** | *By applying process mining as a bridge between data mining and business improvement within asset management, two main application areas can be tackled namely process discovery and enhancement, and conformance checking. Process discovery and enhancement entails the discovery and analysis of how work is done in reality and applying optimization techniques to extract optimal value from physical assets. Conformance checking then goes on to compare workflow in reality to the desired model. Other benefits of process mining include the improvement of communication, process execution, knowledge management and process change management. Both of these application areas use the event logs (workflow log, event history) from the current ERP system.* | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Dr JL Jooste | **Co-studyleader** | |

| *York Theodore Anthony*<br>*Chairperson: Prof JH van Vuuren* | | | | | |
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| **Ouditorium 2** | 09:50 – 10:20 | | **Breakaway 1** | 10:30 – 11:00 | |
| **Titel** | Infrastructure implications of a green economy transition in the Western Cape Province of South Africa: A system dynamics modelling approach | | | | |
| **Abstract** | *In order to meet future goals in reducing carbon emissions, a vast investment into the development of a more energy efficient and sustainable infrastructure is required. This study investigated the infrastructure implications of a green economy transition in the Western Cape focusing on the transport sector. Utilising a system dynamics modelling approach, the research effort aimed to improve understanding of how technical, economic, political, social and environmental factors interact, during such a transition. The research indicated that through the investment into a better public transport system as well as shifting the movement of freight onto the rail network there would be long term positive effects.* | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof AC Brent | **Co-studyleader** | Dr J Musango |

| *Kriege Lara*<br>*Chairperson: Dr L Louw* | | | | | |
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| **Ouditorium 2** | 10:30 – 11:00 | | **Breakaway 2** | 11:10 – 11:40 | |
| **Titel** | A framework for establishing a human asset register for the improved management of people within asset management | | | | |
| **Abstract** | *People are fundamental to the success of managing physical assets such as industrial equipment, infrastructure and commercial facilities. A framework was developed to establish a human asset register in order to address the lack of guidance for asset managers to improve the management of people. As line managers are increasingly becoming responsible for activities traditionally placed within the human resource function, insufficient support is available to overcome weak people management skills particularly existing in the technical areas of a business. This study provides a generic step-based framework to establish a structured reflection of human dimensional information to facilitate the application of people management through asset managers. Structured expert interviews validated the proposed framework to provide a pragmatic method to the identified problem.* | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof PJ Vlok | **Co-studyleader** | Dr JL Jooste |

| *McNaught Mark David*<br>*Chairperson: Dr S Matope* | | | | | |
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| **Ouditorium 2** | 11:10 – 11:40 | | **Breakaway 1** | 11:50 – 12:20 | |
| **Titel** | A risk-reliability comparison of track sections in the passenger railway industry | | | | |
| **Abstract** | A risk-based method which grades track corridors between train stations according to their level of risk was developed. To achieve this, both the likelihood and the severity components of risk were considered to form a risk matrix. Reliability was calculated by quantifying track failure modes first and then analysing the characteristics of failures for each track corridor. Probabilistic models were generated from repairable systems' reliability theory from which reliability predictions were made. Maintenance prioritisation is possible from the risk rankings created by the matrix. The risk rankings for five track corridors were validated when a condition-based track maintenance tool, TQI, was in agreement. | | | | |
| **Degree** | MEng (R) Industrial Engineering | **Studyleader** | Prof CJ Fourie | **Co-studyleader** | Mr KH von Leipzig |

| *Stander Jacques Bernard*<br>*Chairperson: Dr SS Grobbelaar* | | | | | |
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| **Ouditorium 2** | 11:50 – 12:20 | | **Breakaway 2** | 12:30 – 13:00 | |
| **Titel** | The modern asset: Big data and information valuation | | | | |
| **Abstract** | This study details the development of a proof-of-concept valuation method for big data and information. Through the development of this method – Decision Based Valuation – the study shows that there is both grounds for data and information to be regarded as assets, as well as for them to be financially accountable. A detailed description of the method and its application is provided; after which it is validated through two case studies. Furthermore, its need within industry is validated through depth interviews with multiple industry professionals. Concluding the study is review of its successes and areas requiring further research and development. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof PJ Vlok | **Co-studyleader** | Dr JL Jooste |

| *Umeh Ekene*<br>*Chairperson: Mr J van Eeden* | | | | | |
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| **Ouditorium 2** | 12:30 – 13:00 | | **Breakaway 1** | 13:10 – 13:40 | |
| **Titel** | Application of Lean tools in rolling stock supply chain management | | | | |
| **Abstract** | Historically, Lean thinking and methodology have limited applications in the maintenance environment (non- manufacturing environment). As a result, this study reports on the Lean tools that can be implemented in the maintenance environment. To achieve this, a typical supply chain of a Rolling Stock Organisation was used for analysis and validation. The approach for the study is to initially map the current supply chain process through a standard method of value stream mapping so as to identify Non-Lean activities. Subsequent to the current state mapping, the methodology continued by the application of Lean tools contained in the measure, analyse and improve phases of DMAIC (define-measure-analyse-improve-control) systematic approach. Finally, Performance Indicators was be formulated for continuous review and assessment. | | | | |
| **Degree** | MEng (R) Industrial Engineering | **Studyleader** | Prof CJ Fourie | **Co-studyleader** | Dr S Matope |

| *Jonker Willem*<br>*Chairperson: Prof JH van Vuuren* | | | | | |
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| **Ouditorium 2** | 13:50 – 14:20 | | **Breakaway 2** | 14:30 – 15:00 | |
| **Titel** | Biofuel implications of a green economy transition in the Western Cape Province of South Africa: A system dynamics modelling approach to biofuel | | | | |
| **Abstract** | It is generally accepted that biofuel has some environmental advantages. Uncertainty exists regarding the cross-sectoral implications and effects of producing biofuel within the Western Cape Province as part of the transition to a green economy. This study describes the research and modelling approach used to simulate biofuel production within the Province under certain project and policy considerations. A system dynamics model was built in order to identify key strategic intervention points that could strengthen the business case of biofuel production. Recommendations are then made on how to manage and guide biofuel production to facilitate the establishment of a biofuel sector in the Province. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof AC Brent | **Co-studyleader** | Dr J Musango |

| *Coetzee Elaan*<br>*Chairperson: Dr JL Jooste* | | | | | |
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| **Ouditorium 2** | 14:30 – 15:00 | | **Breakaway 1** | 15:10 – 15:40 | |
| **Titel** | Strengthening the public downstream SLD supply chain for MDR-TB: Lessons learned from the Western Cape case study | | | | |
| **Abstract** | Systemic problems in the supply chain of second-line anti-TB drugs (SLDs) for multidrug-resistant tuberculosis (MDR-TB) are well documented and contribute significantly to the difficulties preventing successful control of the disease. Though literature contains a wealth of proposed changes to global SLD supply chain policies, there is a significant research gap related to quantitative modelling of the SLD supply chain to accurately predict the expected impact of these proposed changes on the availability and delivery of SLDs. The global SLD supply chain consists of two components: (i) the ``upstream'' component which includes all activities from the manufacturing of the active pharmaceutical ingredient through to the warehousing of drugs prior to shipment; and (ii) the ``downstream'' component which includes in-country warehousing and delivery of drugs to various healthcare facilities. A model of the current downstream segment of the supply chain for SLDs in the Western Cape was developed using a System Dynamics modelling approach. The model has been built and validated using real-world data provided by the Western Cape Department of Health (WCDoH). This model has been used as a platform for (i) studying the behaviour and stability of the downstream component of the global SLD supply chain; and (ii) testing the impact of various supply chain policy changes that have been proposed. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Me L Oosthuizen | **Co-studyleader** | Mr KH von Leipzig |

| *Heyns Hannes*<br>*Chairperson: Prof AC Brent* | | | | | |
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| **Ouditorium 2** | 15:10 – 15:40 | | **Breakaway 2** | 15:50 – 16:20 | |
| **Titel** | The township start-up: A collaboration platform that bridges the gap between developed and developing South Africa | | | | |
| **Abstract** | There exists a massive gap between developed and developing South Africa. This study introduces The Township Start-up which explains how this gap can be breached through enterprise engineering and how a platform was developed to do exactly that. The work superimposes human behavioural sciences, a culture of Ubuntu, exponential technologies and transforming entrepreneurial practices to determine how the source of the gap can addressed. A collaborative approach is proposed through which these challenges can be addressed together and highlights the competitive advantages which can be leveraged to do so. BioTRIZ methodology is used to develop a platform which facilitates collaboration through mutually beneficial partnerships between individuals, organisations and educational accreditors. The finer details of the platform and how it is prepared for further development and implementation, are explained. An action learning validation process is used to experimentally test whether the platform would work as it is designed to and whether the platform might serve as a potential solution to help breach the gap between developed and developing South Africa. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof CSL Schutte | **Co-studyleader** | Dr L Louw |

| *Swart Petrus Daniel*<br>*Chairperson: Dr Stephen Matope* | | | | | |
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| **Ouditorium 2** | 15:50 – 16:20 | | **Breakaway 1** | 16:30 – 17:00 | |
| **Titel** | An asset investment decision framework to prioritise shutdown maintenance tasks | | | | |
| **Abstract** | In this study, a new framework called the Shutdown Maintenance Prioritisation Framework (SMPF) is developed to prioritise the maintenance tasks proposed for an upcoming shutdown on a critical asset. Limited maintenance resources, such as time and budget, are considered in the prioritisation process, in addition to the value delivered by each maintenance task. Value is measured in terms of return on investment, which is the reduction in risk cost achieved by performing a combination of maintenance tasks on the asset relative to the costs incurred. The developed framework selects the combination of maintenance tasks that delivers the greatest return, whilst adhering to the aforestated constraints. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof PJ Vlok | **Co-studyleader** | Dr JL Jooste |

# STIAS: 30 October 2015

*Botha Louis Jona*
*Chairperson: Dr SS Grobbelaar*

| **Ouditorium 2** | 08:30 – 09:00 | **Breakaway 1** | 09:10 – 09:40 |
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| **Titel** | Identifying quantitative relationships between key performance indicators in support of physical asset management decision-making processes | | | | |
| **Abstract** | The QRPMS methodology aims to provide additional information for improved PAM decision-making processes. QRPMS objectively identifies and quantifies relationships between a set of KPIs using PCA and PLS regression, respectively. The K1 criteria is employed during the employment of PCA, however it is very unreliable and inaccurate, severely compromising the reliability and mathematical accuracy of the results obtained from QRPMS. The QIIPMR methodology is an improved version of QRPMS, employing it as a foundational framework, and replaces K1 with more accurate and reliable alternatives. A case study is conducted, comparing the results of QRPMS and QIIPMR using real-world KPI data. The case study results substantiate the improvement made to QRPMS methodology. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Dr JL Jooste | **Co-studyleader** | |

*Brown Stephen*
*Chairperson: Dr S Matope*

| **Ouditorium 2** | 09:10 – 09:40 | **Breakaway 2** | 09:50 – 10:20 |
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| **Titel** | A SCM approach to project management in the South African construction industry | | | | |
| **Abstract** | The construction industry repeatedly encounter challenges in managing projects. The two factors that motivated this research were, the failure of construction projects to adhere to budget and schedule and the lack of insight into the management of complex construction projects in South Africa.<br>The purpose of this study was to evaluate if there exist alternative approaches to managing construction projects other than conventional project management as per the Project Management Body of Knowledge. Current Project management principles were evaluated and compared with management practices commonly employed in the manufacturing industry, more specifically, in the field of Supply Chain Management. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Mr KH von Leipzig | **Co-studyleader** | |

| *Walker Emma*<br>*Chairperson: Dr T Oosthuizen* | | | | | |
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| **Ouditorium 2** | 09:50 – 10:20 | | **Breakaway 1** | 10:30 – 11:00 | |
| **Titel** | Motivating human assets in the field of physical asset management | | | | |
| **Abstract** | Effective task execution is essential to asset intensive companies as it influences production and asset utilization. However, persuading employees to execute their assigned activities is recognized as one of the most challenging tasks that managers are confronted with. It has been identified that line managers are required to take over duties traditionally addressed by the Human Resources department despite being rarely sufficiently trained in Human Resource Management techniques and practices.<br><br>This study proposes a framework to provide managers of a primarily technical background, with a tool to assist them in assessing the extent to which aspects of motivation are utilized in the working environment. The aim of the framework is to facilitate these managers in establishing an environment with the highest potential to motivate their employees to perform work related tasks. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof PJ Vlok | **Co-studyleader** | Dr JL Jooste |

| *Zastron Carel Mauritz*<br>*Chairperson: Dr SS Grobbelaar* | | | | | |
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| **Ouditorium 2** | 14:30 – 15:00 | | **Breakaway 2** | 15:10 – 15:40 | |
| **Titel** | Improving information reporting in data-intensive organisations by determining individual data presentation preferences | | | | |
| **Abstract** | Advancements in data capturing capabilities of organisations have allowed them to collect and store more data than at any other time in corporate history. However, it is reported that as much as 70% of this data is never used. This study proposes an information encoding framework which recommends a presentation format based on the needs of the target audience. The study was validated by consulting 20 managers from six different data-intensive organisations. The full complement of managers indicated that reports tailored to their personal preferences would be of value of them, while 95% of the managers believed that the proposed information encoding framework could improve data communication in their organisations. | | | | |
| **Degree** | MEng (R) Engineering Management | **Studyleader** | Prof PJ Vlok | **Co-studyleader** | Dr JL Jooste |