Optimising Service Centre Competitiveness using Lean Enterprise Philosophy and Simulation Techniques

Grace Mukondeleli Kanakana
Faculty of Engineering and the Built Environment
Tshwane University of Technology
Pretoria West, South Africa
KanakanaMG@tut.ac.za

Olasumbo Ayodeji Makinde
Industrial Engineering Department
Tshwane University of Technology
Pretoria West, South Africa
olasumbomakinde@gmail.com

Abstract

Lean enterprise and simulation techniques have been applied in many service sectors, however the application of lean enterprise and simulation techniques in government department service centers leaves a lot to be desired. This paper intends to demonstrate how process chart (used as a lean tool) and system simulation model were used to identify and measure the wastes and service disruptions (bottlenecks) present within the service center as well as suggest possible strategies capable of eliminating them. Action research was conducted in a service center, as a result, data was collected and analyzed. The result of the process chart analysis of the service center operations revealed that customer excessive movements and high customer queue time are the wastes present within the process. The simulation results of the service center revealed that the Payment and FLO stations are the bottlenecked stations. Merging of the Information Line Center and Meeter Greeter work stations as well as Payment and FLO work stations, were foreseen as suitable strategies capable of eliminating the wastes and bottlenecks in the service center. Furthermore, increase in staff capacity of these amalgamated work stations were anticipated as another strategy capable of catapulting customer service delivery rate in this service center.

Keywords
Lean enterprise, System simulation, Service center, Competitiveness

1. Introduction

Lean serves as a potential technique that can be used to improve service efficiency in the public sectors. The pressure of its usage in public sector is increasing daily as a result of clamour for optimal service delivery by political oppositions. This forces government agencies in public sectors to look at ways to improve service delivery in order to be re-elected during the local elections. Politicians and legislators aims at improving the people's (community) satisfaction when receiving services from public sector and at the same time they are challenged to be innovative. In order to make this possible, public sectors are espected to standadize processess, provide services online and to streamline as many process as possible.

Lean enterprise can assist the public sectors to realise this requirement if applied effectively. Studies by[1]and [2] indicate that lean can be applied in service sector whether it is in public space or cooperate space. Tools like 5S and 7 wastes can be used to achieve basic stability and line balancing can be used to streamline processes and reduce cycle time and queueing time.

Process inprovements need validation before implementation. Simulation can be used to determine if streamlining the service processes will result on the sustainable improvement or not. In light of this, this study intends to outline how lean enterpise philosophy and simlution technique can be used to measure and improve the efficiency of the goverment service centers.

Lean has being used by many sectors to improve performance [3], Arnaboldi outline that public sectors are adopting lean practices with the aim to improve service delivery. The introduction of information system and online system enables the goverment to look for better ways to provide optimal service at a reduced cost [4]. In South Africa, the country is faced with many social and economical challeges. To this effect, implementing lean can help to save and optimize the use of resources which can be used to address most of these challenges.

2. Literature Review

Lean has being used by many sectors to improve performance[5]. Public service organisations have come under pressure to improve the efficiency and service delivery to their customers. Hence, they are looking for ways to get sustainable improvement and streamlining processess. Goverment have to find ways to reduce cost, improve management of resources and to satisty their customers. Therefore, their only option is to adopt lean processes with the believe that this strategy will yield the expected results.

Lean have been defined by many authors[1, 2, 4, 6]. However, what all the authors have in common is that Lean is a technique that involves "doing more with less amount of inputs governed by the principles of waste reudction"[1]. [7] states that the level of interest in lean thinking as a means of change in public sectors is increasing, this is because public sectors want to use techniques that have being used in private sectors like lean manufacturing. The questions was that: Can lean thinking be applied in public sectors? just as it is being applied in private sectors particularly in manufacturing since it was established for manufacturing enviroment.

Study by [8] indicate that lean principle have being adopted in service industries and there are many evidence of lean application in health sectors. Hence, the application of this techique to other sectors is possible. [8] indicated that lean tools and techiques can be applied to any process which need improvement, hence there is no reason why govermnet sectors cannot apply lean.

Kaizen Bliz, Six Sigma and Value Stream Mapping (VSM) are amongst the most utilised continuous improvement tools in goverment sectors. Case studies have revealed how lean improved process have been generated from an health care queueing system and how it has been used to reduce abandoned vehicles in public works directorate [8]. This thus illustrate that different goverment departments are utilising lean tools to improve service delivery.

In South Africa, tools like 5S and 7 wastes was used in health care to improve service delivery in public hospitals. The study by [9] illustrate how lean was used to improve patient queueing time using tools like Value Stream Mapping (VSM), tack time and line balancing. According to [10] in his study titled "an investigation of the usage of lean in a south african revenue services branch office", lean tools like 5S, waste reduction (7 Waste), Value Stream Mapping (VSM), Queueing management (line balancing) can be applied to improve service delivery at SARS [10].

One of the challenges experienced in implementing lean in public sector is getting the employees to utilise this tool and convincing them that implementing lean will yield benefits [11]. Having this in mind, management need to know the value proposition before they fully engage on improvement. It is for this reason, that simulation was used to determine whether line balancing and process improvement at the service center will result in improved service delivery. The study by [12] propose the use of discrete simulation, business game and involvement of project team to reduce the barrier of rapid implementation of solutions in public sector. It is for this reason that discrete simulation was used to show the extent of results that can be achieved should lean tools be implemented effectively.

Discrete simulation have being applied to solve a wide varied of problem in health care such as patient waiting time, operational perfomance and others[12-14] to mention but a few. These techniques have also being applied to solve similar problems in service sectors [15-18]. In goverment sector, discrete simulation has being used by [19, 20] to improve waiting time, queueing time and operation performance, which in the long run improve service delivery.

3. Methodology

We presented the data of the real life operating condition of the South African Service Center ABC. This data was obtained through system observation and interrogations with the operations manager of this company. Based on this data, all the activities carried out by the work stations of the South African Service Center ABC was documented using a process chart. In addition to this, the different wastes present in this system was also mapped. Also from this data, we virtually modelled and simulated the South African Service Center ABC on the SIMIO software. We analysed the productivity performance of different work stations of the virtual South African Service Center ABC model. Based on this result, we proposed some strategies that could be used to reduce customer service delivery time and enrich customer satisfaction in South African Service Center ABC.

4. Results and analysis

System observation and interrogation with operations managers of South African Service Center ABC revealed that the arrival rate of the customers per hour between the working hours of 8am and 4pm are 45, 32, 42, 56, 61, 34, 19 and 5 respectively. In addition to this, this data collection method also revealed that customers are serviced by the workers of the South African Service Center ABC positioned at the Information Line (two workers), Payment (two workers), Meeter Greeter (one worker), Photo Booth (one worker) and FLO stations (four workers). The set of activities carried out by different work stations of South African Service Center ABC, in processing the customers' requests is highlighted in the process chart depicted in Table 1.

Table 1. Process Chart of South African Service Center ABC

Step No.	Time (minutes)	●	➡	■	◗	▼	Step Description
1	-		X				Customer arrives at Service Center ABC and approach the service center worker at the Information Line Center station.
2	2	X					The service center worker at the Information Line Center, ascertains the type of service operation required by the customer, verify and captures the identity of the customers, and thereafter direct the customer to the Payment section.
3	0.4		X				Customer go to the payment section
3	8	X					The service center worker at the Payment section collect the amount of money required to carry out the customer service operation using a credit card swiping machine.
4	0.4		X				Customer go to the service center worker at Meeter Greeter station.
5	0.5	X					The Meeter Greeter worker directs the customer to the Photo Booth station.
6	0.4		X				Customer goes to the Photo Booth station.
7	0.2	X					The Photo Booth captures the image and finger-prints of the customers.
8	0.4		X				Customer go to the FLO station.
9	30	X					The service center worker at the FLO station process the service requests of the customer.
10	0.7		X				Customer leave Service Center ABC after his service requested have been processed.

From this process chart, it was inferred that, five (5) distinct operations and six (6) movements was undergone by each customer for a period of 40 minutes, 50 seconds respectively, in order to process their request. In light of this result and information obtained during the system observation, it was inferred that the current wastes present within this

system are: (1) excessive movements during service operation and (2) high customers' waiting time that emanates owing to long queues experienced during the service operation. In order to measure the efficiency of the service delivery in South African Service Center ABC and based on this result, ascertain the possible strategies that could be used to eradicate these wastes in South African Service Center ABC, a virtual reality model and simulation of this system was sought by the authors. The step by step procedures followed in modelling the real-life operating condition of South Africa Service Center ABC on SIMO is depicted in Figure 1.

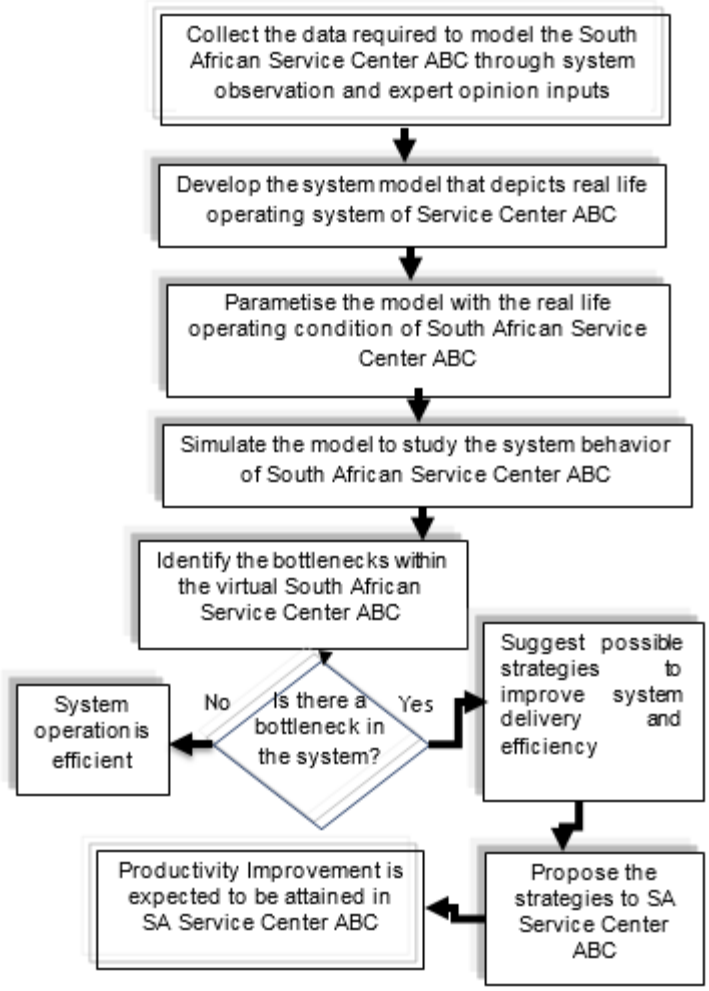


Figure 1. Research Framework

In light of this, the step by step parametrization of the model objects combined together to represents the real-life operating condition of the South African Service Center ABC is depicted in Figures 2a and 2b.

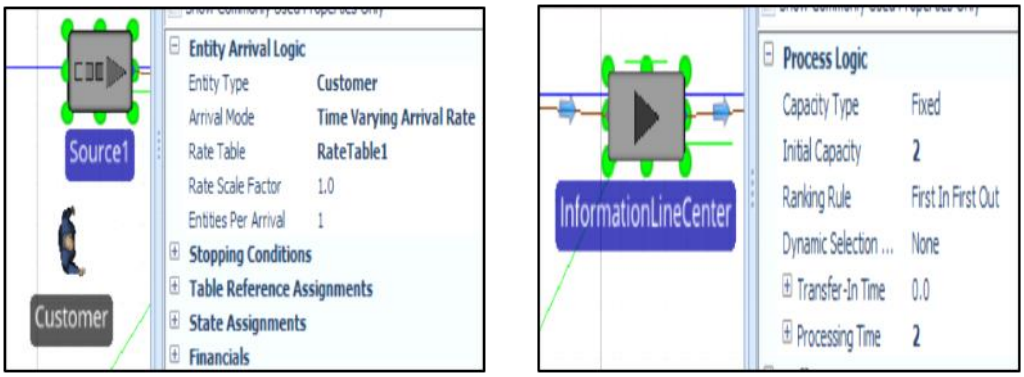
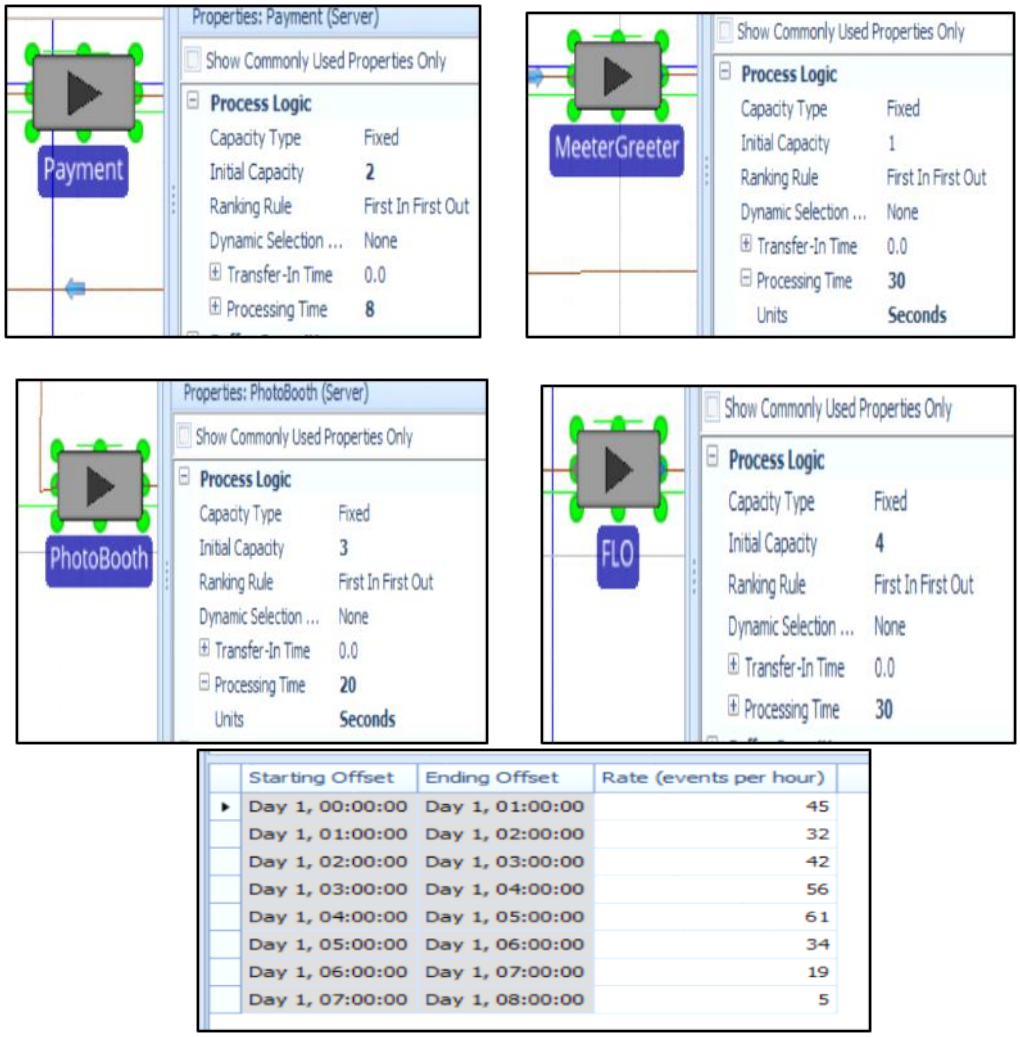


Figure 2a. Parametrization of the Virtual South African Service Center ABC model



Starting Offset	Ending Offset	Rate (events per hour)
Day 1, 00:00:00	Day 1, 01:00:00	45
Day 1, 01:00:00	Day 1, 02:00:00	32
Day 1, 02:00:00	Day 1, 03:00:00	42
Day 1, 03:00:00	Day 1, 04:00:00	56
Day 1, 04:00:00	Day 1, 05:00:00	61
Day 1, 05:00:00	Day 1, 06:00:00	34
Day 1, 06:00:00	Day 1, 07:00:00	19
Day 1, 07:00:00	Day 1, 08:00:00	5

Figure 2b. Parametrization of the Virtual South African Service Center ABC model

The virtual reality system model of the South African Service Center ABC is depicted in Figure 3.

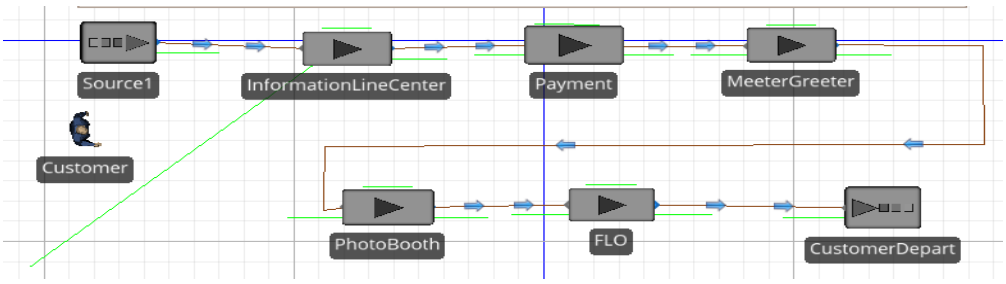


Figure 3. South African Service Center ABC model

Simulation of the virtual real-life South African Service Center ABC resulted into Figure 4.

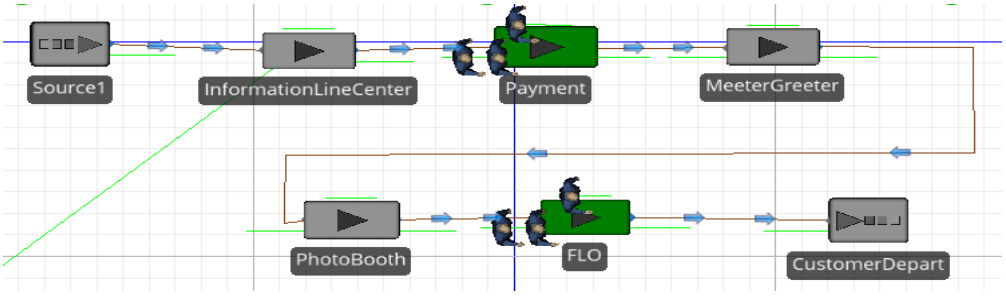


Figure 4. Simulated model of the Virtual South African Service Center ABC

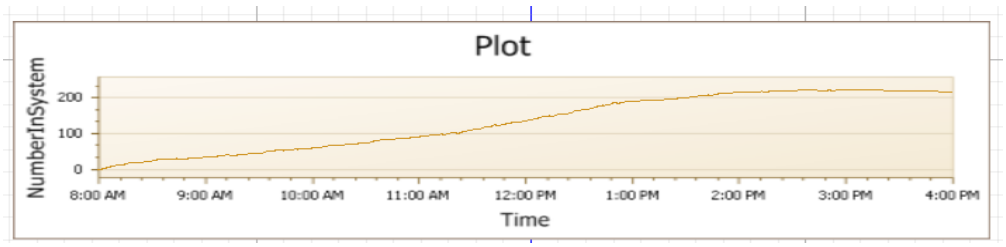


Figure 5. Instantaneous number of customers that are South African Service Center ABC system

Based on the simulated result of the model depicted in Figure 5, the instantaneous number of customers seen in South African Center ABC system to be serviced (i.e. in queue) is roughly about 33, 67, 100, 133, 199 and over 200 customers between the periods of 8 – 9 am, 9 – 10 am, 10 -11 am, 11 – 12 am, 12 – 1 pm and 1 – 4 pm respectively. This thus, implies that only eight (8) customers were fully served on hourly basis, while four (4) customers are currently in the FLO work station to be serviced. Based on the simulated result of the model depicted in Table 2, exactly two hundred and seventy-six (276) customers that arrived to be serviced at the Information Line Center were all served. However, out of two hundred and seventy-six (276) customers that arrived at the Payment Work Station, only one hundred and eighteen (118) workers were served, leaving one hundred and fifty-eight (158) customers unserved. Exactly one hundred and eighteen (118) customers that arrived to be serviced at the Meeter Greeter and Photo Booth Work Stations were all served. However, out of one hundred and eighteen (118) customers that arrived to be serviced at the FLO Work Station, only sixty (60) workers were served, leaving fifty-eight (58) customers unserved.

The utilization and the percentage starved time of the Information Line Center, Payment, Meeter Greeter, Photo Booth and FLO work stations were 70.45% and 29.55%, 99.13% and 0.87%, 12.29% and 87.71%, 8.19% and 91.81% and 97.19% and 2.81% respectively. The number of instances that the Information Line Center, Payment, Meeter Greeter, Photo Booth and FLO work stations were starved (during working hours of South African Service Center ABC) for 141.83 minutes, 4.2 minutes, 421.02 minutes, 440.64 minutes and 13.5 minutes are 59, 1, 119, 119 and 1 respectively. In view of this, it could be inferred that the bottlenecked stations are Payment and FLO work stations due to the high number of unserved customers in these stations. Further to this, the Meter Greeter and Photo Booth work stations were underutilized, which thus results in no usage of these stations for 421.02 minutes and 440.64 minutes respectively (i.e. a waste).

Table 2. Throughputs of different work stations in South African Service Center ABC

Throughput	Information Line Center	Payment	Meter Greeter	Photo Booth	FLO
Customer that stayed on the queue to be serviced	276	276	118	118	118
Customer serviced	276	118	118	118	60
Customer not serviced	0	158	0	0	58
Utilisation of each Work Station	70.45%	99.13%	12.29%	8.19%	97.19
Time that each Work Station was starved (mins)	141.83	4.2	421.02	440.64	13.5
Percentage time that each Work Station was starved (%)	29.55%	0.87%	87.71%	91.81%	2.81%
Number of instances (occurrences) that each Work Station was starved.	59	1	119	119	1

To exploit and alleviate these bottlenecks as well as alleviate the different wastes identified in this system, the merging of the Information Line Center and Meeter Greeter work stations into a single work station (which service the customer for one minute) were suggested by the authors as a possible strategy to reduce the over-all queue time of the customer and eliminate underutilization of the Meeter Greeter work station. Furthermore, the merging of the Payment and FLO work stations into a single work station (which service the customer for 35 minutes) serve as a potential strategy that could improve the overall throughput of this system from 8 serviced customers per hour to about 12 serviced customers per hour. In addition to this, the addition of more workers to this merged work station could drive the serviced customers per hour to the optimum level (which is the exact number of customers that arrived to be served). 5S was also implemented in the South African Service Center ABC to sort out the needed files from irrelevant files, neatly arrange this work environment and establish schedules and methods of cleaning and sorting files in this work environment. Furthermore, the development of sustainable customer service process monitoring and measurement system as well as an effective customer complaint resolution system were also foreseen as other strategies that could be used to expedite customer service delivery and satisfaction in this service center.

5. Conclusion

In this study, we investigated how Lean techniques could be applied to improve customer service delivery in a South African Service Center ABC. During the course of the study, excessive movements of customers from one work station to another work station (i.e. excessive transport), high waiting time, and underutilization of Meeter Greeter and Photo Booth work stations were the current wastes and bottlenecks present in South African Service Center ABC. In addition to this, the bottlenecked work stations in South African Service Center ABC are the Payment and FLO service stations. Based on these results, the merging of the Information Line Center and the Meeter Greeter stations as well as the merging of the Payment and FLO stations; with an increase number of servicing staffs were proposed by the authors as suitable strategies capable of optimizing customer service delivery in South African Service Center ABC. Furthermore, 5S was also implemented in Service Center ABC in order to ensure the use of good housekeeping practices in this system.

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Biographies

Grace Mukondeleli Kanakana is an Assistant Dean of the Faculty of Engineering and Built Environment at Tshwane University of Technology. She earned her B-Tech industrial from the University of Technology South Africa, Masters in Business administration from Nelson Mandela University, and PhD in Engineering Management from University of Johannesburg, South Africa. She has published journal articles and conference papers pertaining to need areas from an industrial engineering perspective. Dr Kanakana has carried out research studies with various research institutes and universities within South Africa and beyond. Her research interests include manufacturing,

quality, benchmarking, optimization, project management, and lean six sigma. She is a member of local and international professional organizations.

Olasumbo Ayodeji Makinde was born in Ibadan, Oyo State, Nigeria. He completed his B-Eng. Degree in Mining Engineering in Federal University of Technology, Akure, Nigeria in 2011 and served his country from 2011 to 2012 in Ulysses Private College, Nigeria. During his undergraduate days, he has being opportune to undergo field work activities in Dangote Cement Factory, Obajana, Kogi State, Nigeria where he learnt a lot about drilling, crushing and mineral processing operations in the quarry. He is an Associate Member of Association of Entrepreneurs and Technologist in Nigeria. He is currently doing his PhD Degree programme at Tshwane University of Technology, Pretoria in the department of Industrial Engineering and intends to specialize fully in Reconfigurable Manufacturing Systems (RMS) and Process Optimization (OP). He has written different papers circumventing around RMS in order to suggest directions for technology and manufacturing development in South Africa.