

Embracing Total Quality Management in Manufacturing Value Chains For Global Competitiveness Post-Covid Economy

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Abstract

Quality is innate in manufacturing value chains as it acts as a determinant for the level of desirability on the customer end. This is in terms of the level of satisfaction based on durability, performance, continuous improvement and the quality of product justifying the sale price. Total quality management is enriched with various methodologies and principles all focused on the level of performance, productivity, customer relations and service management. It is therefore very critical that for a country to improve on the purchasing manager index (PMI) and global competitiveness, the inherent aspects of quality should be enhanced and embraced as this can contribute to the level of domestic sales in the economy as well as the level of attraction in terms of products being sought in the export markets. South Africa currently has experienced a 12% decline in productivity in comparison to the 90's, this has become even worse in the covid-19 economy, whereby there is a 7% contraction in the overall sectors of economy. Currently industry across quarters is bleeding as a result of cheap imports from China and poor competitiveness within the local industry. The steel sector in one such sector that used to flourish but has suffered a downward spiral with the closure of key industry players such as Accelor Mittal. Currently there is a development of a steel master plan under way to address the current deficiency in the level of productivity, competitiveness and local content. The paper in its critical analysis will emphasize on the importance of total quality management philosophy, specifically the 5S methodology, Total Quality Management, and joint improvement tools being inherent within the industrial development incentive value chains as a motive and drive for greater productivity and global competitiveness.

Keywords:

Total Quality Management, Manufacturing, Competitiveness

Introduction

Factory activity has expanded significantly because of the easing of lockdown rules, the PMI in October 2020 is a true reflection of this notion more drawing a comparison to the predicted pre pandemic figures. Whilst this is celebrated it is essential that we reflect back on the industrial challenges that have been present prior to lock down; which comprise of the need to re-industrialise, as to enable diversification beyond the economy's reliance on traditional commodities resulting in promotion of value addition; additionally realizing the need to compete in export markets against imports, labor absorbing industrialization coupled with hi-tech in skills embraced by total quality management philosophy.

The paper draws a correlation between the quality management and resultantly leading to improved productivity within manufacturing value chains it is essential that quality management philosophy is extrapolated accordingly, by devising the cause-and-effect analysis. According to Kerzner (2001), Total Quality Management (TQM), refers to an ever-improving system for integrating various organizational elements into the design, development, and manufacturing efforts, providing cost-effective products or services that are fully acceptable to the ultimate customer. The author further alludes that TQM externally provides a more meaningful customer satisfaction and internally a reduction of bottlenecks in the production line thereby minimizing operational costs, therefore enhancing product quality and improvement of organization's morale.

This is indeed a desired state required for South Africa for a thriving manufacturing industry and industrialization as a whole; the newly developed Africa Free Trade Agreement looks at how nations can benefit meaningfully through trade, in terms of meaningful trade between African nations, in terms of comparative and competitive advantage. To realize these nations, have to identify their strength in processing manufactured products of high quality and at competitive rates meeting global standards, this increases room for attracting an export driven economy and a high skills base in the economy. Currently the African continent faces the challenge of being more of a consumer and less of a producer as the vast raw material is exported in its raw state and they imported into the continent as a finished tertiary product.

Literature Review

Pillars of Total Quality Management

According to Total Quality: A User's Guide for Implementation (2020), businesses must on a continuous basis seek initiatives to improve processes and adapt products and services as customer needs advance, for the purpose of customer relations and service management, this process is efficiently facilitated by Total Quality Management 6th pillar of Continual Improvement, this technically entails:

* Implementation of policies to establish product, process, and system improvements as measurable goals for individuals, teams, and departments;

*Recognize, acknowledge, and encourage innovation to improve processes and development.

*Encourage employees to participate in available training sessions to learn and take on new and additional roles. Integral to the above the the User's Guide for Implementation (2020), highlights on the benefits realisation as follows:

Improved knowledge and capabilities to increase performance

Improvement goals strategically aligned with organizational capabilities and goals

Quick reaction times to recognize and fix bottlenecks and broken processes

Pillar six of total quality management has a pivotal role in industrial manufacturing value chains, from conceptual approach and benefits realisation as it possesses the capability of implementing of continuous improvement processes; more so as it inculcates an ideal systems thinking to be applied in production processes and manufacturing value chains and enhances the propensity to contribute towards enhanced knowledge insight, learning organisation, process and product improvement, customer service and relations management; thereby communicating and contributing adequately to an export driven, growth oriented, skills oriented and sustainable outcomes based manufacturing and industrial development.

In this regard the embracing of the quality management system for calibration laboratories is accredited against : ISO/IEC 17025; SANAS technical requirements documents; and is under the custodian of the South African National Accreditation System; the process applied ensures there is a linkage between the National Measuring Standards, and the working standards, test and measurement equipment utilised in industry. In relation to the 9 pillars of TQM this is in accordance with the 4th pillar of integrated system, facilitating for inter-connectivity of horizontal processes within value chains this ensures thorough understanding of policies, standards, objectives, and processes. In the final analysis acting as an enabler for continual improvement achieving an edge over the competition, Total Quality: A User's Guide for Implementation (2020).

Lean Six Sigma

Six Sigma refers to a commitment in the improvement of productivity and profitability in a project or operational environment, it requires a high level of activity and hands-on practice from a dedicated team that is results oriented, Brue (2002). The application of this approach in practice can be referenced as early as 1980 at Motorola, this is its initial inception and evidence-based approach towards its application.

In relation to the Six Sigma approach, Bill Smith a revered reliability engineer, in upholding the approach ascertained that in the event assembled products being completely free of defects, the possibility of customers querying the product at a later stage equates to minimal, Brue (2002). Considering this, a further advancement was made to the methodology, whereby Dr Mike Harry, the founder of Motorola Six Sigma Institute foresaw the methodology beyond just waste reduction but also contributing to the company bottom-line.

The above assertions are essential in terms of creating sustainable industrial value chains in the manufacturing value chains in South Africa, contributing towards competitiveness, export driven economy, localization, and labor absorbing industrialization. Currently the regress in the Manufacturing sector in South Africa lies in the

inability to compete globally, which the contributing factors lies in the high costs of production and dearth of skills upholding quality management systems during production. Therefore, in embracing total quality management in manufacturing value chains, it becomes essential to adopt lean six sigma as to minimize waist contributing to high costs of production; the resultant of this is greater competitiveness and greater company bottom-line and growth.

Kaizen

Venter (2022) refers to Japanese business philosophy of Kaizen as being essential as it intends to gradually improve productivity by involving employees and making the working environment more efficient; in acknowledging this philosophy, the Automotive Industry Development Centre Eastern Cape (AIDC EC) has forged partnership with the Japanese International Cooperation Agency. The aim of the partnership is with the intent to roll out the Kaizen implementation programme aimed at improving competitiveness of component suppliers in the South African automotive industry.

Venter (2022), further highlights on the key focal area of quality and productivity improvement as being a catalyst for capacitating suppliers, accessibility to new markets, and the attaining of international benchmarks; this consequently leads to competitiveness improvement. This is a great initiative taking into cognisance the previous empirical results from Kaizen programmes at eight Tier 1 South African components manufactures; which reflect that between 2016 to 2019 there had been a significant improvement in terms of rate of production more than doubling, additionally on-time delivery improving from 73% to 95%. Finally, in relation to the human talent component, the overtime work sub-component on average regressed from 13.8 hours a week to 4.6 hours a week, lead times on average improved by 40%.

The application of Kaizen philosophy in the automotive sector is indeed a progressive implementation tool right across sectors if applied and can create a climate conducive towards resolving the downward trend encountered by the manufacturing industry over the past three decades. The regress reflects on a 12% decline in terms of contribution to GDP in 2019, this is from a 17% regress in 2017 and an aggregated decline of 21% from 1990.

Application of Kanban philosophy in manufacturing

Kruger, Rampal and Maritz (2013), allude that Kanban technique refers to a visible record or signal whereby a communication system is utilised as an enabler for customers to indicate their order specification and their continuous order cycles. Because of the timing factor and sequential analysis of a Kanban system there lies an innovative continuous improvement process in the system.

For an effective Kanban system, it is essential that it comprise of specification information on product, such as the part number, brief description, type of container, quantity in the container, origin of the container and destination of the container, Kruger (2013) *et.al.*

Kruger (2013) *et.al.*; further asserts value addition in the manufacturing supply value chains ensuring efficiency during production as well as overall operational competitiveness it is essential that a buffer inventory system in the form of Kanban be integrated into production lines; as the system contains three basic Kanban cards, the initial one used is conveyance (C Kanban) card, also referred to as the move [M Kanban] card); its key purpose entails the authorisation of withdrawal of components in an integrated process.

This is sequentially accompanied by the (P Kanban) card responsible for production phase, authorising the initiation of the production of new batches for components. The final card utilised is assigned to the supplier, (S Kanban) card; authorising external suppliers to deliver a new batch of materials or components. The process is halted upon the inventory levels reaching optimum level, this is informed by signals indicating good quality, in line with specification, there should be precision, accuracy and consistency in obtaining material from supplier, Kruger (2013) *et.al.*

The above approach can be applicable in enhancing value to the sustainable aviation agreement entered into between Sasol and Deutsche Aircraft entailing the development sustainable aviation fuel technology. From a practicality and integration point of view Kanban of things would entail Sasol (supplier) developing a communication system utilised as an enabler for Deutsche Aircraft (customer) having an order specification taking into account a holistic approach to climate-neutral aviation focussing on whole value chain from fuel production up to aircraft system level.

Competing Through Development Capability

Wheelwright and Clark (1992), ascertain that in a competitive environment that is influenced by forces of globalisation, there emanates an intense dynamic need for the development of new products and processes which bring about a resultant outcome of competition. The authors further allude that in turbulent environments performing product and process development has become an essential for competitive edge; generically the forces driving development comprises of intense international competition, fragmented, demanding markets and diverse and rapidly changing technologies. These are key essential lessons learned for South Africa's manufacturing and industrial development to thrive post the covid-19 economy. Currently there is great articulation on localisation of sectors entailing competitiveness improvement and driving export driven economy and growth; this however needs to be informed by evidence-based localisation, which takes into account the level of imports and exports in the economy and the marginal propensity to compete in markets. According to Creamer (2021), South Africa imports goods worth 25% of GDP; therefore, the propensity to import is imbalanced in relation to peer countries and developed economies with the ability to sustainably produce locally for the export market.

To assert more on the above, in terms of comparisons in relation to South Africa's importation of goods worth 25% of GDP, China, India, Brazil, the United State of America and European Union are sequentially at 14%, 16%, 10%, 12% and 14% in terms of ration of imported goods to GDP. In light of comparisons and benchmarks on exports it is advised that government implements a policy informed by evidence based localisation; which is supportive of employment creation and increased economic competitiveness, Creamer (2021).

In this approach of evidence based localisation it should be noted that South Africa's ratio of import and exports to GDP is similar to that of numerous countries, additionally imports are essential for development as well as support towards innovation and exports, as a result of an integrated global supply value chain this sequentially results in the need for imported capital goods to support the exports of manufactured products. The strong link between exports and imports should not be disregarded as for instance the automotive industry provides an example of whereby success in exports cordially dependant on a significant input ratio of imports, Creamer (2021).

The New Industrial Competition Driving Forces & Development Realities

In light of the above assertion, it becomes essential to refer again on the Wheelwright et.al in relation to the three key critical forces driving development. These comprise of Intense International Competition, Fragmented demanding markets and Diverse and rapidly changing technologies.

Intense international competition: As world trade has expanded and global markets are reachable, a greater challenge for competitors lies competing with firms that have evolved in various environments in North America, Europe and Asia. The net effect being to make competition more intense, demanding and rigorous and as a result creating an environment of adaptation or falling off, Wheelwright and Clark (1992).

In the African context the Africa Free Trade Agreement has been incepted with the intention of creating a free market in the continent, in the advancement of this concept taking into cognisance the rife global competition it would be ideal that the concept of regional value chains be adopted into the free market agreement; this takes into account that none of the African countries not even the largest has a domestic market of sufficient capacity to drive competitive sustainable industrialisation; the remedial action lies in moving in the same direction by adopting regional value chains engaged in the production of value added goods and services and the trade in intermediate goods that made entry into the larger African market of 1.2 billion people of a combined GDP of \$ 2.3 trillion, Creamer (2021).

Fragmented, demanding markets: Wheelwright & Clark (1992), ascertain that consumer market across the globe has become exceedingly complex and demanding, and for industries and sectors to remain abreast it becomes essential for them to adjust and adapt in terms of ensuring high levels of performance and reliability in the production lines and final produce readily made for local market and export. In relation to this development the specific paragraph content highlights on the New Ranger's rise in production motive as well as the rise in exports and other industrial indicators resulting from the expansion of the production lines propelled by the Tshwane Automotive Special Economic Zone, Venter (2021).

Venter (2021), highlights on the projected economic and continuous improvement benefits resulting from the expansion of Ford Motor Company plant at the earmarked Tshwane Automotive Special Economic Zone. In terms of the economic benefits of the R 15.8 billion expansion programme, an increment of 1200 jobs in projected at

Ford South Africa, this further entails an additional 10 000 new jobs across the automaker's local supplier network. Furthermore, this endeavour will lead to the Next-Generation Ranger being assembled at the plant, having access to the South African market as well as penetrating 100 global markets inclusive of the entire African continent.

In terms of the innovative continuous improvement processes resulting from the endeavour it can be anticipated that the expansion of the production facility will act as an enabler of the manufacturing of 200 000 vehicles a year, which is 32 000 increases in comparison to the former. The transformation processes at the Silverton plant are focussed on modernisation, enhancement of efficiency and improvement of production quality throughout the entire plant. This approach increases the capability of producing more than a hundred left- and right-hand drive markets globally, Venter (2021).

Diverse & Rapidly changing technologies: The growing dimension of scientific and technological knowledge has necessitated an increasingly open and competitive market. The development of innovative technologies and advancement in existing technologies has ameliorated the approaches of engineers and marketers in their search for latest products. Latest technologies in materials, electronics and biology have capability in terms of drastically changing the approach to business and the nature of competition, Wheelwright, and Clark (1992).

In light of the development highlighted in relation to approach to business and competition the author ascertains that forces are feeding right across industries, and are the heartbeat of competition in young, technically dynamic industries, this is also further applicable to mature industries where life cycles are historically long, technologies mature and demands stable, Wheelwright and Clark (1992).

The above assertion has a symbiotic relation to South Africa's industrial development and will reveal more of itself in the post Covid-19 economy; to motivate on this pointer, it has become apparent that various sectors in the manufacturing industry have seen the need to advance and adjust to the demands of 4th IR and artificial intelligence as part of gaining traction in the globally competitive environment. Furthermore, the integration of the green hydrogen economy has also become apparent in response to the COP26 strategy for 2030 in terms of decarbonisation levels. Therefore, the production value chains of the future will have the integrated 4th IR and green hydrogen systems integrated into the production lines as an endeavour for compliance and reaching high production efficiencies and capacity.

To shed more light to diverse and changing technologies in relation to the 4th IR and green hydrogen a brief discussion will be highlighted on the mining industry as well as the steel industry. In the mining industry a dog like robot has been launched in South Africa (Referred to as Robotic Miner or Spot) as a means to automate hard to reach mining environments, it applies a variety of mining applications. Its core function includes seismic surveys, gas detection, laser scanning, conveyor belt line and tunnel inspection and search and rescue operations, Slater (2021).

Spot or Robotic minor has further been designed to conduct autonomous operations, comprising routine autowalks, above and underground operations. Additionally, as a property of the 4th IR environment it can be controlled remotely by an operator, who has 360 degrees visibility because of forward-facing, side and rear cameras, enhanced in low-light environment infrared capability off the shelf. This device further has a property of navigating environments easily without the constraints faced by drones and wheeled /tracked robots, Slater (2021).

Additionally, it is designed to carry a variety of payloads of up to 14kg, inclusive of high-resolution and zoomable camera, light detection, and ranging sensors; thermal imaging, auditory sensors to identify audible leaks such as compressed-air leaks; and food, water and medical supplies for search and rescue operations. It further has a function to monitor remote construction progress, as well as monitoring hazardous environments and provision of situational awareness, Slater (2021).

Having provided a highlight on the internet of things and machine learning in relation to the mining industry, as an interlink to rapidly changing technologies, the next phase highlights on the green premium; this particularly reflects on the global steel industry approach towards sustainable solution as part of compliance with COP 26; this approach has been taken by South Africa and counter-parts in the production of green iron-ore or steel; this is in response to the combating of the carbon emissions, of which the steel industry accounts to roughly 7%, in terms of projections by Wood Mackenzie emissions by steel sector must drop by 75% as to limit global warming to two degrees Celsius.

Application of 5S in processing of industrial development applications

5S is defined as a methodology that results in a workplace that is clean, uncluttered, safe, and well organized to help reduce waste and optimize productivity. It's designed to help build a quality work environment, both physically and mentally, (5S Today 2021, **Online**).

In the space of industrial development from the financing perspective, 5s entails proper filing of project applications and claims having adequate spacing for the packs as well as appropriate application of ergonomics amongst employees. Additionally, the resources approach towards filing and cleanliness on their desk ensuring there is a systems approach in terms of inflow and outflow of work in relation to their surroundings, and remaining conscious of the turnaround time for productivity in terms of processing the applications and claims of industrialists.

The process improvement internally within the Industrial Financing Division, facilitated through application of 5S will automatically filter into the industrial manufacturing value chains post the incentivisation phase. According to Kerzner (2001), Total Quality Management (TQM), refers to an ever-improving system for integrating various organizational elements into the design, development, and manufacturing efforts, providing cost-effective products or services that are fully acceptable to the ultimate customer. The author further alludes that TQM externally provides a more meaningful customer satisfaction and internally a reduction of bottlenecks in the production line thereby minimizing operational costs, therefore enhancing product quality and improvement of organization's morale.

The Key Essentials for AFCTA for Competitive Regional Value Chains

AFCTA's envisaged plan for the African continent is packaged around regional trade value chains operating in a liberalized trade environment in the continent with less quotas and tariffs impeding free trade and efficient movement of imports and exports; this is very appropriate in terms of creating such a common market with a population of 1.2 billion and a GDP of \$ 2.3 trillion Creamer (2021); accompanying this approach is the emphasizing manufactured value added products and graduating away from export of primary products to tertiary as this will result in a high level of competitiveness and export driven economies impacting positively on nations balance of payments. In the ensuring of high value-added manufactured products it is essential that industries and sectors are accustomed to the application of tools pertaining to innovative continuous improvement in the value chain; it is disheartening for South Africa, which can be considered as Africa's central economic hub to be ranked as number 22 out of 38 countries in terms of global competitiveness.

The localization concept is also factored into the equation more so emphasis being on that localization strategies should identify and remove constraints for local producers, as an enabler for them to compete with foreign suppliers. The most recent research by TIPS has identified key hindrances towards localization as comprising of inadequacy of information relating to market opportunities, high-cost or poor quality infrastructure, inputs and skills; lack of accessibility to markets locally and abroad, Parker (2022).

Competitive Excellence in Readily made Goods for Export

According to Steyn(2020a), for Africa to benchmark with competitive economies it is essential that the following elements of competitive excellence are adopted into the manufacturing regional value chains; the sectors has got to comprehensively adopt a customer focused approach, emphasize on the provision of goods and services that customers want and ensure retention of the cliental market, these goods and services should result from carefully planned and executed transformation processes and the industries and sectors should instill the customer focus culture within the organization more so the employees engaged in the entire production and system value chains.

Additionally, to the competitiveness excellence approach the drivers of competitiveness should be embraced in the regional value chains; this entails a high focus on the extent of **productivity**; highlighting on the general ability to manufacture efficiently and effectively meeting the customer expectations and beyond, secondly the ability to integrate the **e-commerce** factor into the production lines, this is looking at the actual manufacturing and the final transaction process performed as well as logistics within value chain, thirdly ensuring **order-fulfillment**, whereby customer needs dates and requirement drive processes , additionally manufacturing, distribution and transportation plans are intergrated. Fourthly, **teaming and partnering** becomes an essential, sequentially followed by outsourcing and finally the distinctive core competencies as well as human talent inclusive of leadership

excellence are essential in achieving an overall competitiveness in industry. Having highlighted on competitiveness component relating to regional value chains the next phase of the paper is to discuss the quick response philosophy in relation to regional value chains.

The Baldrige Business Model In industrial manufacturing value chains

Leonard.D, (2022:Online) ascertain Baldrige is a firm structure that enhances and enables organization to reach objectives, improve results, and become more competitive. It integrates tested practices on contemporary leadership and management issues into a set of questions that assist in the management of all the components in organization as a unified whole. This tool can act as an enhancer for a sound industrial development policy informing the implementation arm of industrial development incentives, based on feedback loop from industry needs and developments advancing towards sustainable industrial development in manufacturing value chains in the post covid-19 environment.

To highlight further on this assertion it is essential to draw an integral analysis between the quality dimension in the model communicating that quality management precipitates the propensity for organisations to effectively and efficiently meet their missions as well as to achieve their visions. This approach when applied towards the various industrial development strategies and frameworks such as the automotive sector's manufacturing of electric vehicle in order to comply with COP 26 as well as the retention of the 65% European market, would realise benefits of strategic importance for South Africa. These comprises of advancement in skills to work on EV production lines, job creation, and original equipment manufacturing in support of import minimisation strategy or localisation, Frost (2022).

Application of Quick Response Philosophy in Regional Value Chains

As the prevailing situation in Africa is and its common markets, the reality is non has a domestic market of sufficient scale to drive significant industrialization; the solution in this regard lies in the emergence of regional value chains engaged in the production of value added goods and service and trading in the global African market. This being a comprehensive solution should also be accompanied by the ability to apply the philosophy of quick response taking into cognizance the level of poor road, rail, port, telecommunication and other infrastructure enhancing the level of competitiveness in manufacturing value chains and export driven economies.

In ensuring the remedy to this challenge it is ideal that AFCTA in its approach of enabling efficient free trade the areas interlinked such as logistics and JIT (Just in time) are paid attention to, as quick response (QR) and JIT both rely on efficient IT (information technology) freight and distribution management (logistics). Subsequent to this factor it is essential that the technology and quick response be integrated into the manufacturing and export value chains; whereby the universal product codes, scanning of equipment at the export one stops are deployed, sequentially there should be sufficient and efficient data communication hardware, as well as electronic data interchange software. This should also be accompanied by good human relationships and re-engineering processes at various critical points of the manufacturing and export value chains.

Application of Joint Improvement Tool in Regional Manufacturing value chains

The reality in the African continent is that the majority of the export market comprises of primary products and less of tertiary; South Africa which can be considered as the most industrialized country in the continent was recently ranked number 22 out of 38 countries in terms of global competitiveness ranking, this does not compare well in terms of the level of competitiveness; for Africa to advance in terms of being globally competitive it is essential that joint improvement tools be adopted across the industrial sectors; the following is a detailed approach on the application of this measure:

Joint Improvement Tools

The TQM dimension is a critical component for competitive manufacturing regional manufacturing value chains, as it extensively communicates to customer relationship management, relationship with suppliers, product design and transformation processes. To a greater length it is complemented by components of joint improvement tools such as the Just-in-time, Benchmarking, Re-engineering, Supplier Development, Total Preventative Maintenance, Quick Response Programs, finally Team creation and building. Specifically highlighting on the total quality aspect, the following process flow plays an informative role in terms of systems approach applicable to embracement to total quality management systems in manufacturing value chains.

Total Quality Management (TQM):

The TQM dimension is a critical component for competitive manufacturing regional manufacturing value chains , as it extensively communicates to customer relationship management, relationship with suppliers, product design and transformation processes; to add more to this point the schematic diagram below highlights on the competitive benefits of TQM:

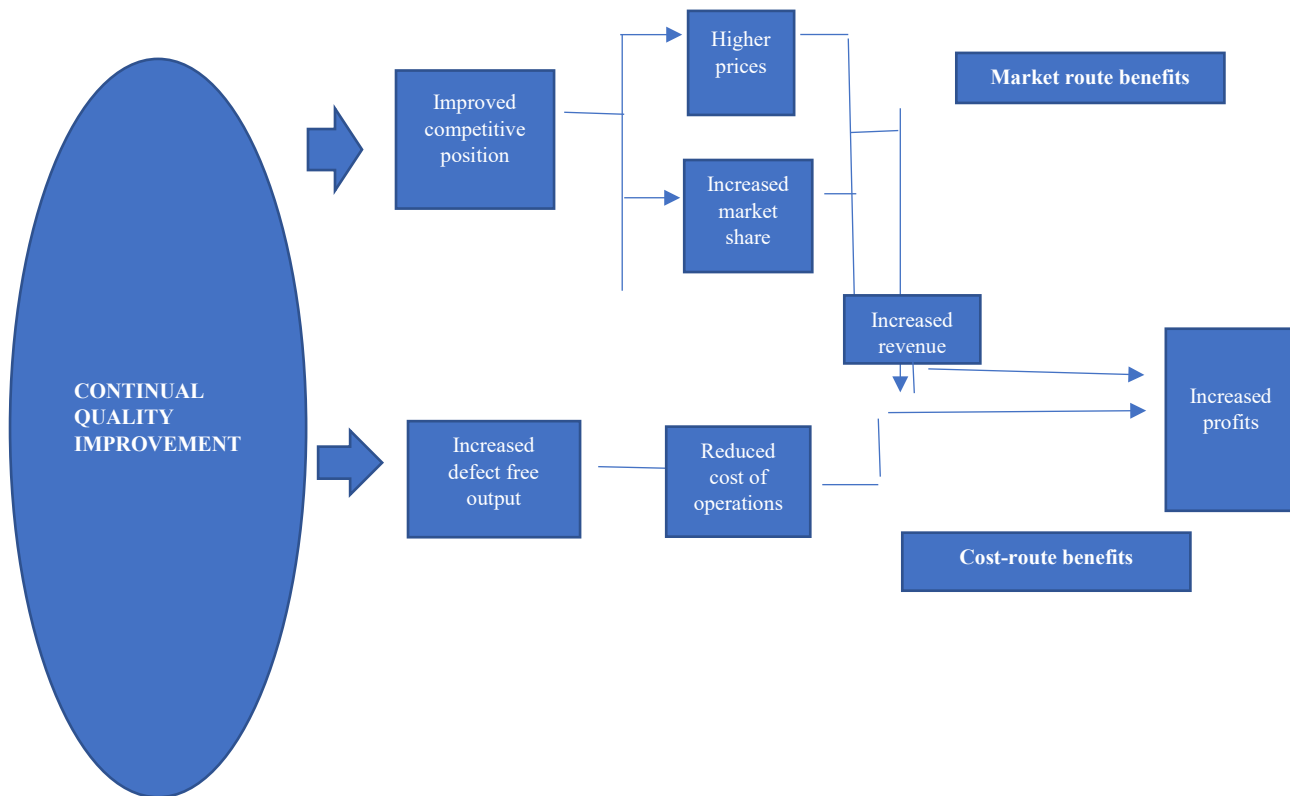


Figure 1. Competitive Benefits of TQM (Source: Adapted from Steyn, 2020).

Afcta, African Economies & Infrastructure

According to (Makhubela. D, 2021 **Online**), Afcta is to cover 55 countries in the continent , hosting a population of 1,3 billion people and collectively with a GDP of \$ 3,4 trillion, the intention for the free market is to eliminate 90% of the tariffs on trade enabling an efficient free trade and regional integration, in terms of a World bank report it is anticipated that regional income will rise by 7% or by \$ 450 billion and furthermore creating a conducive climate for 30 million people to be alleviated out of extreme poverty by 2035 as the agreement facilitates for economic stimulus and feeding into growth and wages. This will further enhance intra-continental exports to increase by 81% and exports to non-African countries by 19%.

Subsequently; through this initiative it is estimated that export will be increased by \$ 560 billion and the largest contributor being manufacturing, for this to be fully realized it is therefore an essential that regional manufacturing value chains be created in order for significant industrialization to suffice, as highlighted earlier in the paper this approach will require sectors and industries in the continent to adopt , embrace and implement culture of competitive excellence , quick response philosophy and joint improvement tools relating to the final manufactured goods for consumption. Furthermore, integral to this requires robust, rail, telecommunication, road and ports infrastructure.

Methodology

Quantitative research was applied, entailing a collection and analysis of numeric data on the impact of covid-19 on the manufacturing industry in South Africa as well as the proposed way forward pertaining the application of total quality management systems in enhancing productivity post-covid-19, leading to competitive enhancement, growth and export driven economy.

The information was collected and analysed from a variety of sources on industrial and quality management focussing on the manufacturing industry in South Africa more so factoring the covid pandemic.

Data Collection

The quantitative analysis was based on research from various sources and journals analysing the state of manufacturing industry prior, during and possibilities during covid; taking into cognisance the need to advance manufacturing value chains by embracing total quality management systems.

Results and Discussions

In the long-term, the South Africa Manufacturing PMI is projected to trend around 49.00 points in 2021 and 51.00 points in 2022, according to our econometric models (South Africa GDP Annual Growth Rate - 1994-2019 Data) This raises an alarming question regarding where went wrong in terms of industrial development as Manufacturing's contribution to GDP was at 24% in early 1980s and regressed to less than 13% in 2017.

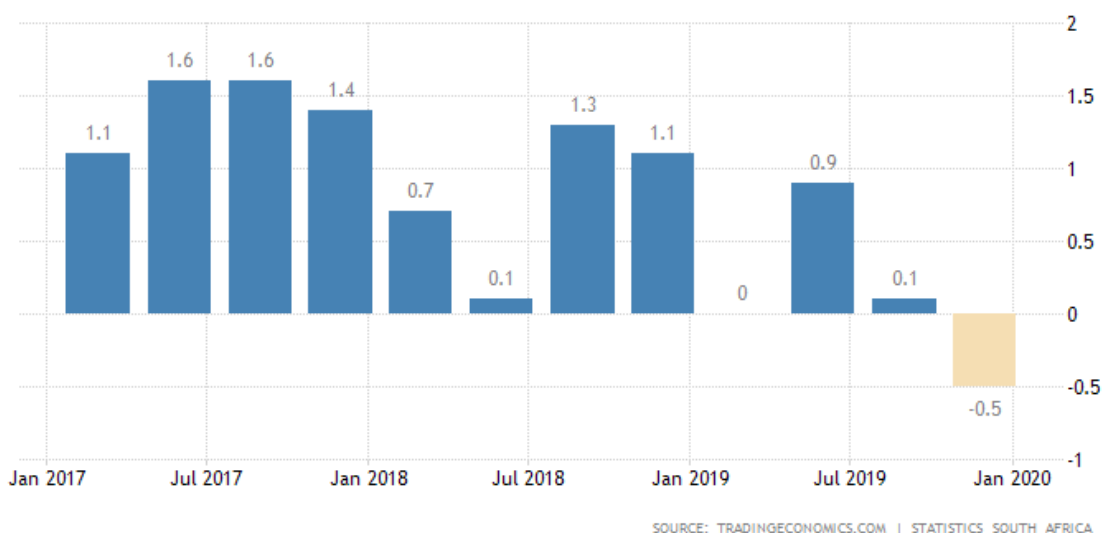


Figure 2. South Africa GDP Annual Growth Rate - 1994-2019 Data | 2020-2022 Forecast | | (Source: Adapted from Trading Economics, 2020).

Figure 1 outlines that between 2017 to early in 2019, GDP has been staggering in the ranges between 0% - 1.6% growth rate; then from mid-2019 there was 0.9% growth, subsequently followed by a 0.1% growth rate; then a drastic drop in January 2020 to negative growth of 0.5% GDP.

This trend in reflecting minimal and negative growth in GDP can be attributed to Moody's and Fitch global credit ratings down grade South Africa due to poor governance and corruption precipitated in South Africa's state-owned entities resulting in load shedding, unemployment rate which is at 29%, negative growth in the financial year, expenditure on GDP at 62.2%, and a myriad of other economic deficiencies. Worst case scenario is a further [5 – 7%] contraction in economic growth resulting from COVID-19.

The Current and Forecasted Performance of the South African Economy during and Post Covid-19

COVID-19 has led to another predicament to the South African economy, this is from both the micro and macroeconomic perspective, whereby 75% of SMME's will close-down, furthermore an additional 400 000 jobs

could shed, an additional provision of R 150 billion being sourced post corona for economic sustenance. Currently there is conflicting views regarding sourcing a loan from the IMF to service economy post COVID-19, as 5 -7% contraction is projected an economy on negative growth resulting from Moody's downgrade, (Boonzaier 2020 & De Lange 2020).

According (Trading Economics,2020: **Online**) it is projected that lock down will result in the further regress in the purchasing manager's index (indicator used to measure level of productivity in industry). The PMI manufacturing index has been on a down slope for the past eight month.

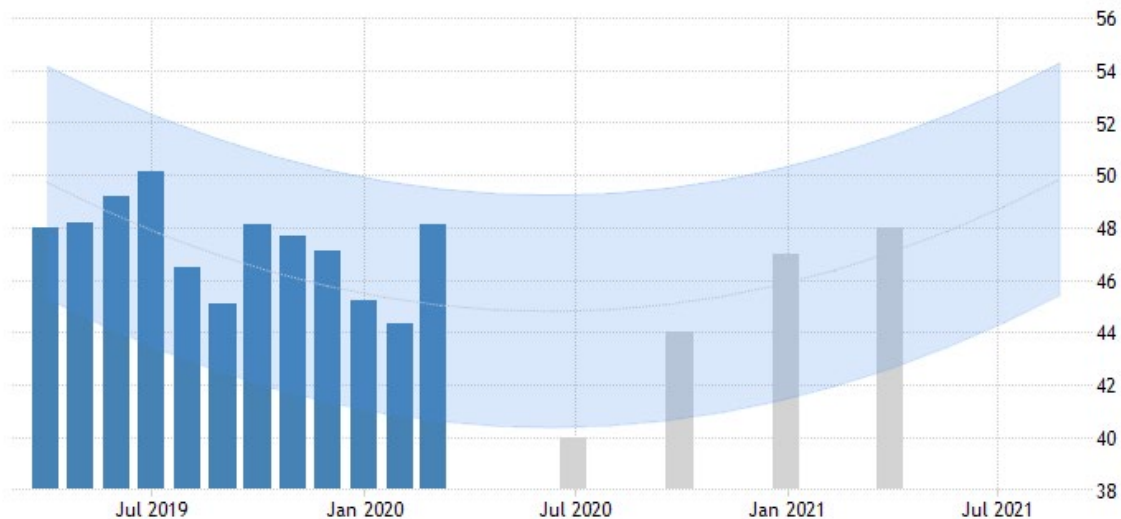


Figure 3. South Africa Manufacturing PMI - 1994-2019 Data | 2020-2022 Forecast | (Source: Adapted from Trading Economics, 2020).

Figure 2 explains the actual PMI manufacturing trend covering 2019, early 2020 and furthermore provides projections for middle of 2020 going in 2021, in terms of the actual figures it is reflected that the PMI rose 48.1 in March 2020, whereas previously it was at 44.3; prior to March 2020 there had been a downward slope since October 2019 as a result of contraction in industrial activity, this comprised of slower delivery times, these delays are an indication that suppliers are busier under normal circumstances; this substantiates that the coronavirus pandemic clearly impacted adversely on global supply-chains, (Trading Economics 2020: **Online**).

Conclusions

For a productive economy to be realised post the Corona crisis, Viegi, N. (2020), suggests that expansion and diversification are foreseen as the key drivers of long-term growth. By engaging in exports strategy, exporting national firms can capitalise on becoming more productive, competitive and innovative. This is in line with the National Integrated Export Strategy aiming to increase national export from the current 0.02% to contributing 2% in 2030 (DTI 2017: **Online**). On the industrial financing side, the DTI and development finance institutions (DFI's) provides industrial development incentives in supporting the country's industrial policy action plan. The industrial development incentive programmes are inclusive in the Master Plan with the aim of supporting and developing the manufacturing sector as well as developing an export driven economy which is globally competitive as well as enhancing skills development in terms of contributing to product and process improvement. The positive effect on this is that productivity increase wages and standards of living and generates resources for public services and redistribution. For long-term growth and resilience, there should be an incentive to boost public investment in health, education and infrastructure (Bloomberg 2020).

Additionally, a limitation to monopoly power, promotion innovation and increase in accountability, transparency will result in a competitive environment. This scenario presented further reinforces the sentiments by Mwambari. D, 2020: **Online**), ascertaining that this pandemic could lead to the decolonization of Africa , in terms of self-reliance, further economic reforms, prioritization of African markets, innovation and local manufacturing embracing the objective behind the establishment of Africa Free Trade Agreement. Additionally, this initiative will lead to gradually to Africa industrial development programs diverting from foreign funding to national funding drawn from taxation and repatriated funds and new higher-value exports.

This perceived economic overhaul requires greater investment into the development of social sectors, such as healthcare being prioritized thereby stimulating growth of local pharmaceutical industries and biotechnology. Furthermore; another key priority would be greater investment into education and innovation sector.

There is a massive impact coronavirus is having in the economy and its effect in manufacturing. What will happen next will depend how Covid-19 crisis will evolve. It is hoped that this virus will be contained and will slowdown in future and production can now resume and economy can go back to normality. This should certainly bring relief to the South African people. We hope the lagging down of the virus will help companies to bounce back relatively quickly with the help of tailored government measures. If the virus continues to spread, the government will be forced to extend the lockdown and further harming the economy and supply chain.

The global outbreak of the virus could possibly become an eye opener to the African continent in terms of realizing the dream of self-reliance and utilizing natural and intellectual resources in terms of re-industrializing and developing the continent (Mwambari D 2020).

The new birth of industrial development in South Africa post the COVID-19 should focus on a lessons learned path and focus on integrated industrial development strategy in South Africa, involving government , industry associations , industrialists (1st tier , 2nd tier , 3rd tier, 4th tier within supply value chains) and other relevant stakeholders and assess the state of industry through the means of a SWOT(Strength, weaknesses, opportunities and threats matrix) and develop a path for sustainable industrial development key competencies being operational efficiencies within FDI's supporting manufacturing and industrial development and accompanied by set targets per sector in terms of expected level of productivity, global competitiveness, contribution towards exports and operational efficiencies within supply value chains.

This requires enhanced strategic transformation processes within organisational value chains, influencing (behavioural, structural, operational and innovative continuous improvement) through industrial development systems value chains within the state departments responsible for developing country's industrial development policy and strategy as well as the industrialists meant to benefit from industrial development incentives; whereby operations management approaches such as business and operations strategy , market analysis , financial planning, master planning , demand management, master scheduling and order fulfilment processes are integrated into the national industrial development strategy filtering and feeding into the various sector and industry value chains and accompanied by projections and applied interventions in terms of the desired level of productivity in the South African economy in terms of contribution by manufacturing to Purchasers Managers Index and Gross domestic product.

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