

Lean Manufacturing Adoption and Implementation Barriers in Botswana Manufacturing Companies

Herbert Mapfaira, Michael Mutingi, Keketso Lefatshe, and Thabo Mashaba

Abstract— Lean manufacturing, has been identified as one of the most powerful productivity improvement tools. Many companies across the world, especially in the developed economies have aggressively implemented lean, resulting in drastic improvements in productivity. Since 2008, Botswana has suffered from a decline in productivity. Though productivity awareness training has been provided to Botswana business, productivity remains very low and on a downward trend. This indicates that there are either barriers stopping companies from adoption of productivity improvement tools or hindering the successful implementation of productivity improvement tools. The main purpose of this study was to investigate lean manufacturing adoption and implementation barriers for Botswana manufacturing industry. The study was carried out through a survey of manufacturing companies in Botswana. Results indicate that most manufacturing companies are unfamiliar with productivity improvement tools or lack the technical know-how of implementing the tools.

Keywords— Lean manufacturing, adoption barriers, implementation barriers, productivity.

I. INTRODUCTION

AS a developing country, Botswana has set itself some goals to be attained by 2016, called VISION 2016 [1]. The overall aim of the vision is to diversify the economy in order to reduce the country's reliance on the diamond industry. One pillar (goal) of interest of Vision 2016 is that by 2016, Botswana has to be "A Prosperous, Productive and innovative nation". The vision thus aims at growing the different sectors of the Botswana's economy, such as manufacturing, tourism, and retail. For the above vision 2016 pillar to be achieved, Botswana enterprises must be highly productive since productivity in a country is brought by the impact of economic sectors on the GDP of the country. Manufacturing industry is a major sector of the Botswana economy and its performance is critical to the achievement of the vision 2016 pillar.

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A look at the country's productivity record paints a sad story. There have been serious concerns raised about Botswana's productivity. According to Bank of Botswana Governor, the country's productivity and competitiveness is "embarrassingly low"[2]. Also the Global Competitiveness Report compiled by the World Economic Forum and Botswana National Productivity Centre (BNPC) shows a progressive decline in productivity and competitiveness of the country since 2008. One question that begs an answer is why Botswana is experiencing such a decline in productivity, especially since the BNPC has been running productivity awareness campaigns for the country for over two decades.

According to Magagula-Thobokwe [3], BNPC research has revealed that in Botswana the awareness on productivity issues is about 88%. This means that Botswana enterprises are aware of the benefits of productivity improvement tools. Even though Botswana industry has a productivity awareness of 88 %, productivity remains very low. What could be the reasons for such a low productivity level for the country? According to Salm et al.,'s study, Botswana textile industry suffers from low factory efficiencies [4]. Also, poor work ethic and lack of appropriate skills has been identified as some of the major reasons for low productivity in most Botswana industries [5].

A search in the literature reveals very little publications on Botswana companies adopting productivity improvement practices, which may suggest low uptake of productivity improvement tools. Certainly, based on BNPC's productivity awareness promotion, one may conclude that there is awareness of the benefits of the adoption of productivity improvement tools. The question then is why business is not adopting productivity improvement tools.

One sector that has suffered in Botswana due to poor productivity is manufacturing [4]. Poor manufacturing productivity has had an adverse effect on the economy due to a limited manufacturing base. Locally produced goods are too expensive or of poor quality compared to foreign produced goods, resulting on the Botswana produced goods. Consequently, local goods lose out to competitors' products. The end result is a stagnant or a declining manufacturing sector.

Lean manufacturing is a productivity improvement methodology or approach that considers the expenditure of resources on non-value added activities to be a waste [6]. Lean

manufacturing has been identified as one of the most powerful productivity improvement tools. Value-added activities are activities that are necessary to create value for the end customer. Value is thus defined as any activity carried out during the course of producing a product/service that the customer would be willing to pay for. Lean production is therefore focused on the elimination of all activities that do not add value to the end product. Lean is therefore about doing more with less. Lean manufacturing thus allows for the production of high quality goods at a lower cost, which improves the competitiveness of a company's products/services.

The aim of this study is therefore to investigate the adoption and implementation of lean manufacturing in Botswana's manufacturing industry. This work is necessary since it will allow the identification of lean manufacturing adoption and implementation barriers. Understanding the challenges in the adoption and implementation of productivity improvement tools will assist in the formulation of appropriate strategies to effectively implement productivity improvement tools, which should help the country move a step closer to achieving the Vision 2016 strategy. Improving productivity will result in the increase of the productive capacity of the country which should help the country in becoming self-reliant.

II. LITERATURE REVIEW

Lean manufacturing is derived from the Toyota Production System, established by Toyota Motor Corporation. Companies like Toyota Motor Corporation owe their success and dominance of the world automotive industry to the adoption of lean manufacturing. The methodology is implemented through a collection of tools and techniques into the business processes to optimize time, human resources, assets, and productivity, while improving the quality level of products and services to customers [7]. Its success is underpinned by a cultural change across the business, where the focus of the business is meeting the needs of the end customer.

Lean manufacturing is a tried and tested productivity improvement approach. Its aim is to help simplify and organize a working environment to facilitate identification and elimination of waste from the value chain, and to keep people, equipment, and workspace responsive to what's needed by the customer at any given time. Lean manufacturing has been successfully implemented across the world as a productivity improvement strategy with significant results, especially in developed economies, as well as the emerging economies.

Even though Lean Manufacturing is a key tool in improving productivity, its adoption and implementation has been a major challenge to many companies as it requires a specific way of thinking, philosophy and a management system like the one used by Toyota. Liker described in his book, "The Toyota Way", fourteen principles which provided the foundation of getting Lean right at Toyota [8]. The author divided these principles into four categories all starting with the letter "P" –

Philosophy, Process, People and partners and Problem Solving, known as the so called "4 P" model of Toyota. This means that to implement Lean successfully, a company has to get the four 'Ps' right.

Many organizations are failing to successfully implement Lean because they do not fully understand the essence of Lean Manufacturing and how it actually works [9] [10]. The problem mainly sighted for the failure of lean implementation is the misunderstanding of the real concept and purpose of Lean [9]. Some researchers identified the reason of this misunderstanding as due to cultural differences that occurs during transition or translation of the Lean implementation program [11] [12]. This type of misunderstanding could lead to more major issues such as piecemeal adoption of lean tools and techniques [12], misapplication of lean tools [11] [13], and lack of development of lean culture that support the lean development [14] [15]). An organization that initiates lean implementation without fully understanding the lean concept is therefore not fully prepared for the changes required for the successful implementation of lean, resulting in the failure of the Lean implementation program.

It is argued that, for it to work, lean philosophy and techniques require the adoption of the entire system in a holistic manner, rather than applying techniques in a piecemeal fashion [6]. Roth [16] described Lean as a way of operating that spans from executive strategy setting for developing people and managing business growth to the commitment of the workforce to continuous improvement.

III. METHODOLOGY

The research methodology consisted of a survey of lean manufacturing implementations within Botswana Manufacturing industries. A survey questionnaire was developed, which asked a series of questions regarding understanding of lean, barriers to lean adoption, problems/challenges encountered in lean implementation, and benefits achieved as a result of lean implementation. The questionnaire was designed to accommodate both the firms which have already implemented lean and those that have not. The questionnaire was distributed via email to 175 manufacturing companies selected randomly from different parts of Botswana. The list of companies was obtained from Botswana Export Development and Investment Authority (BEDIA). From the sent emails, 48 emails failed to deliver, this may be due to the reason that either the email addresses were wrong or the person has left that company. The response rate was poor and only 3 completed questionnaires were returned within the stipulated time period. The research therefore refocused on manufacturing companies from Gaborone where survey questionnaires were distributed physically to selected contacts, such as production managers, engineering managers, and quality engineers. Due to time and logistical constraints the questionnaires were distributed to 62 companies and 33 completed questionnaires were returned. Secondary data comprised literature such as books, reports,

TABLE I
SURVEY RESPONDENTS

Number of Employees	Percentage
Less than 25	12
Between 25 and 100	70
Above 100	18
Total	100

studies and internet.

To ascertain lean manufacturing adoption barriers, respondents were provided with a sample of 10 lean manufacturing and productivity improvement tools and then asked to identify, from a list, the barriers hindering them from adopting the tools. The tools provided are: Overall Equipment Effectiveness, Total Productive Maintenance, Standardised Work, Root cause analysis, PDCA (Plan, Do, Check, Act), continuous flow, Just-in-Time, Kaizen (continuous improvement, KPI (Key performance indicators) and SMART goals.

The limitations of this research are that the research uses data obtained from Gaborone as representative for the rest of manufacturing companies in Botswana.

IV. RESULTS AND ANALYSIS

Thirty three companies returned completed questionnaires, giving a response rate of 53.2 %. Table I gives the number and percentage of companies who returned completed questionnaires, based on company size. The company size criteria is based on the definition of Small to Medium Enterprises (SMEs) in Botswana [17]. Of the companies who responded, 12% are small sized companies, 70 % are medium sized companies and 18 % are large companies. Therefore, 82% of the companies that responded to the survey are SMEs.

A. Adoption Barriers

Table II provides lean adoption barriers identified by the research participants. The majority of participants identified lack of familiarity with the productivity improvement tools as the main barrier to lean adoption. This means that 40 % of the participants were not familiar with the productivity improvement tools presented. Intriguingly, the research finding by Magagula-Thobokwe [3] concluded that productivity awareness in Botswana industry is 88%. A question many researchers and policy makers constantly ask is, “if productivity awareness in Botswana is as high as 88%, why is industry not adopting productivity improvement tools?” This

TABLE II

MAJOR BARRIER TO ADOPTION OF LEAN MANUFACTURING TOOLS

Number of Employees	Percentage
Not familiar with tools	40
Tools too costly to implement	12
Lack of staff with sufficient knowledge to implement tools	27
Lack of top management support in adopting tools	21
Lack of cooperation with suppliers to establish lean supply chain	0
Total	100

research indicates that the people who should be implementing productivity improvement tools are really not familiar with the mechanics of these tools, hence may not be aware of the full benefits that can be obtained from lean implementation, which may explain the poor adoption of the tools.

The next major barrier to lean adoption was identified as lack of staff with sufficient knowledge to implement the productivity tools. This indicates that while companies may be aware of the benefits of implementing productivity improvement tools, they are unable to adopt the lean tools due to lack of practical knowledge on how to implement the tools. This finding is consistent with the research conducted by the Lean Enterprise Institute (LEI) in which 31% research participant identified lack of implementation know-how as a barrier to Lean adoption [18]. Notably, 21% of the research participants identified lack of top management support in adopting the tools as a barrier. This further indicates a lack of understanding of the real benefits of lean adoption, especially since only 5% identified cost as a barrier to lean adoption. Interestingly, none of the research participants identified lack of cooperation with suppliers to establish a lean supply chain as a barrier to lean adoption. Not surprisingly, we can't be overly concerned about the effect of the supply network on our productivity before we have optimized the performance of our own operations.

B. Implementation Barriers

Table III provides challenges experienced by participating companies during implementation of lean manufacturing tools. Results show that the main challenges to lean implementation are ‘lack of skilled employees’ and ‘coping with change’. Of the participating companies, 33% felt that these were the biggest hindrances to their lean effort. Lack of skilled employees, identified by 33% of the participants, may also help to explain the low adoption of lean in Botswana manufacturing companies. Without relevant skills, it is a very big challenge to get lean implementation right. As observed by Holweg [20] and Balle [9], many companies are not able to alter and prepare themselves adequately for the formidable challenges, most particularly readiness of personnel and understanding the real essence of lean manufacturing concepts. To succeed, this requires people who understand the essence of lean and change management processes.

TABLE III
CHALLENGES EXPERIENCED DURING IMPLEMENTATION OF LEAN TOOLS

Number of Employees	Percentage
Coping with change	33
Lack of commitment from top management	9
Financial problems	21
Lack of cooperation with suppliers to establish lean supply chain	15
Cultural and social barriers to change	9
Lack of skilled employees	33
Lack of collaboration between different functions	9
Employee resistance to change	27

The fact that companies are reporting ‘coping with change’ as a major challenge indicates that the companies were not ready for the change when they embarked on the lean implementation change journey. Necessary strategies to deal with the change were not therefore put in place. This finding, indirectly, also indicates lack of management support since management should put the relevant structures to allow staff to better deal with the change. Connected to coping with change, 27% of the participating companies reported that employee resistance to change was a major problem to lean implementation. This further emphasises that most companies are not ready for the changes that the lean implementation programme is going to make to the day to day work lives of the participants. Resistance to change is a significant problem in any improvement programme in any organisation. Change requires those affected by it to move away from their comfort zone, that is, to have a change of mindset, which is hard if the employees do not fully understand the need for the change. Change of mindset gives people an aim in their working life and has the potential to change attitudes, so that the employees begin to think differently and are more willing to contribute to the company’s improvement initiatives [10]. Like in any change implementation, staff empowerment is essential for engaging employees which is necessary for the success of change implementation. Empowering employees builds a nurturing environment in which employees can learn, improve and effectively implement goals [19].

Financial problems also feature high on the list of challenges to lean implementation. This finding is not surprising bearing in mind that most Botswana manufacturing companies fall within the SMEs category. As observed by [21], the high cost of lean implementation is one of the problems that keep SMEs away from lean implementation.

V. CONCLUSION AND RECOMMENDATIONS

Lean manufacturing has been identified as one of the most effective productivity improvement tools of the 21st century. Many companies have implemented lean and achieved significant benefits. Botswana struggles with its productivity, and yet Botswana industry is slow to adopt lean manufacturing. The aim of the research at hand is to investigate adoption barriers preventing Botswana manufacturing companies from adopting lean as well as to investigate implementation challenges hindering the successful implementation of lean.

Results of the study show that most manufacturing companies in Botswana fall within the SMEs category, hence, they suffer from lack of resources needed for successful lean implementation. The biggest adoption barriers were identified as lack of familiarity with the lean productivity improvement tools and lack of staff with sufficient knowledge to implement the improvement tools. This indicates that due to the size of the organizations, the companies do not have enough resources to develop personnel responsible for productivity improvement, who can be tasked with developing expertise in

this area. The end result is a lack of understanding of Lean manufacturing practices.

On the implementation barrier the main challenges were identified as inability to cope with change, lack of skilled employees, employee resistance to change and inadequate financial resources. These challenges indicate that most manufacturing companies have not been able to implement the lean change programme properly.

Based on the analysis and conclusions of this research paper, a number of recommendations are summarized below:

- Botswana manufacturing industries need to put a considerable effort in understanding lean manufacturing practices. It is false economy to fail to invest in the development of appropriate Lean productivity improvement skills since in the long run it hinders the growth of the companies.
- To ensure gradual learning, companies should consider starting with the implementation of basic lean tools like 5S and standardised work before moving on to more advanced tools. This also allows the companies to immediately see the benefits of lean implementation which should provide the motivation for further investment in lean.
- In order to reap the full benefits of lean implementation, companies should take a holistic approach, that is, they should fully plan their lean implementation identifying all the required lean manufacturing practices and programme for their implementation, rather than picking and choosing a few tools which may result in a disjointed implementation.
- There is a need for manufacturing companies to include lean productivity improvement in their strategic planning. This will ensure that resources are set aside for lean implementation and it will also make the lean implementation to be driven by the business needs.
- Most of the lean adoption and implementation barriers are associated with lack of adequate resources. There is a need for statutory agencies supporting Botswana industry, mainly SMEs, to come up with programmes to support organisations beyond awareness raising.

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