

The Impact of Automation on Jobs in South Africa: A Multi-Sector Case Study

Draft Paper Presentation

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Outline

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Introduction

- In the context of developed countries, the impacts of technology and jobs are well understood (Acemoglu and Autor, 2011; Autor and Salomons, 2017).
- However in less developed countries, these effects are less well interrogated.
- The purpose of this paper is to use qualitative methods to ascertain how automation and automation decisions impact employment and skills.

Automation in Developing Countries: Literature

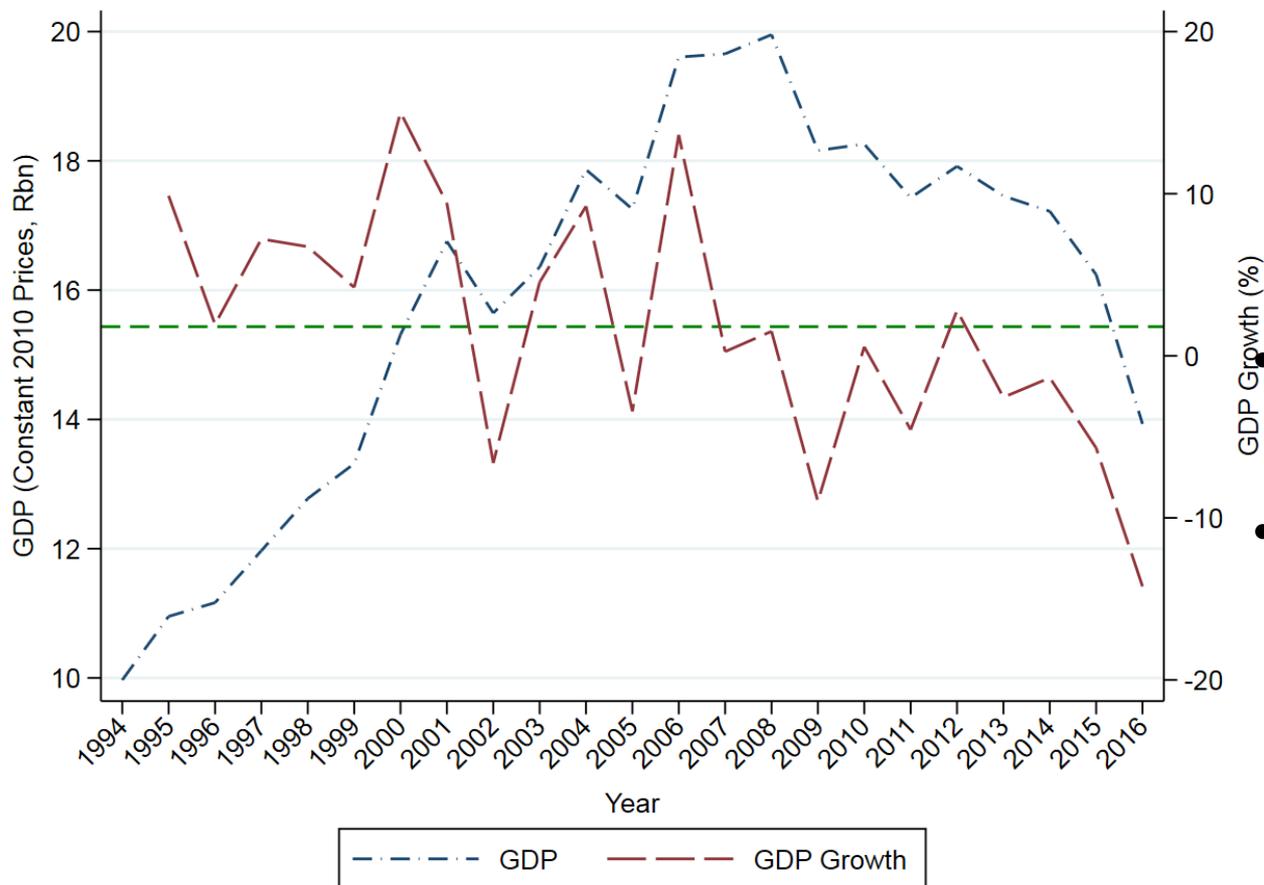
- Ugur and Mitra (2017) suggest that the employment effects of technology adoption are likely to be positive when looking at skilled employment and product innovation.
- Using firm level data, Cirera, Lage and Sabetti (2016) show that there is a positive employment effect of product innovation. This effect, is largest in least developed countries, and in the Africa region where firms are less advanced in technological development. The authors also document that process innovations that involve the automation of production do not have a short-term negative impact on firm employment. However, they do document some evidence of a negative impact of automation on employment when increases in efficiency reduce the elasticity of new sales to employment (Cirera, Lage & Sabetti, 2016).
- While the evidence of automation on employment is mixed, the WEF (2017) documents that in developed and developing countries alike, the most relevant effects of the impact of technology and job are found in the composition (skills-biased), rather than in the level of employment

Research Question and Methodology

- Research Objective: To see if in practise there is a higher adoption of automation by firms that employ manual routine workers. And if so, what the impact is on employment and skills.
- Methodology: Qualitative interview based case studies of medium sized South African firms across different sectors.
 - Furniture
 - Metals
 - Plastics
 - Retail (To be completed)
 - Agro-processing (To be completed)

Furniture – An Overview: GDP

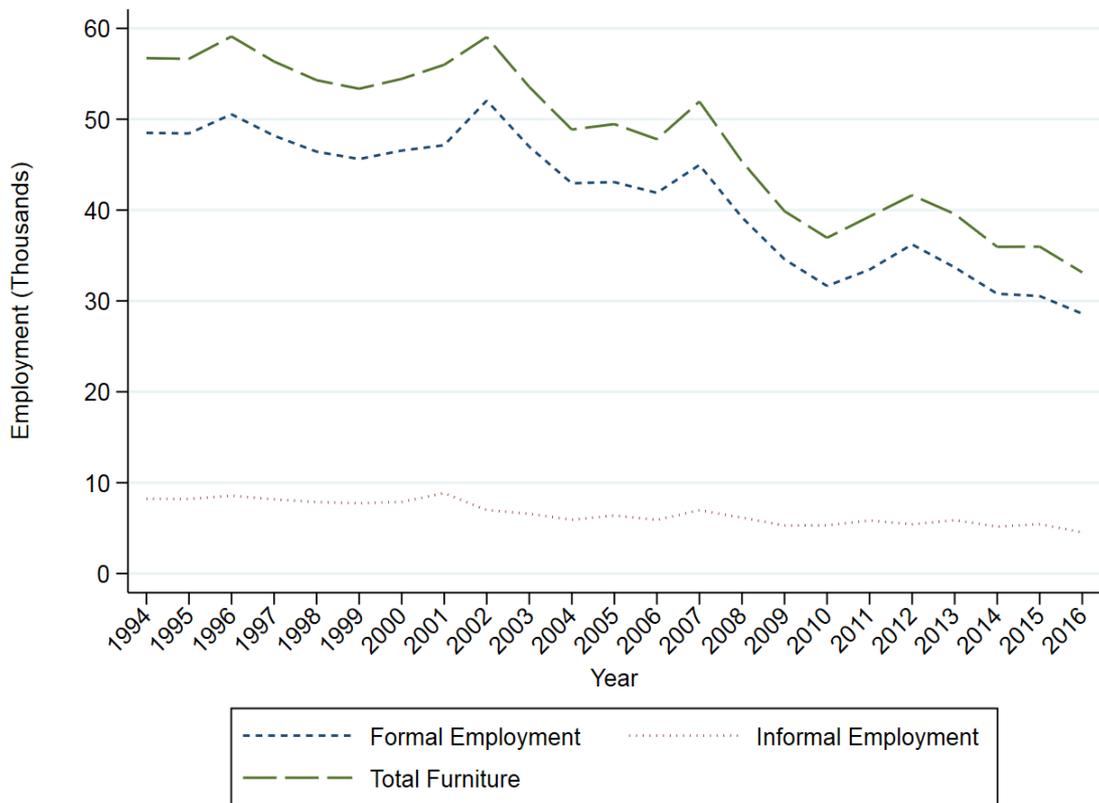
Figure 6: Furniture GDP and GDP Growth, 1994 - 2016



- The furniture industry is very small in South Africa – throughout the entire period, it only contributed between R10 and R20 billion to South Africa’s GDP
- The average GDP growth over the period was 1.79%.
- There is some volatility in the sector with high growth rates recorded in 1995 (9.87%), 2000 (15.01%) and 2006 (13.62%) followed immediately by a low growth year

Furniture – An Overview: Employment

Figure 7: Furniture Employment by Employment Type, 1994 - 2016.



- Total employment has dropped from 56 723 in 1994 to 33 141 in 2016.
- Around 80% of this decline can be attributed to a fall in formal employment.
- The remainder is from informal employment which experienced a reduction from 8 224 workers in 1994 to 4 542 in 2016.

Source: Quantec (2018), own calculations.

Furniture – An Overview: Wage Levels

Figure 9: Annual Real Wages and Real Wage Growth for Furniture Workers, 1994 – 2016



Over the period the average annual wage in the sector was R63 136.

In 1994, the average furniture worker was earning around R35 000 a year. In 1996 and 1997, the average wage had dropped to R31 000 a year.

Between 1998 and 2010, wages grew consistently, reaching R99 074 in 2010 – more than treble what the average furniture worker was earning in 1997.

Between 2011 and 2013, there was a small drop in real wages to R95 505, which then subsequently rose to R100 789 in 2014. This dropped to R95 250 in 2016.

Furniture – Case Study

- The furniture manufacturer interviewed is based in Kwa-Zulu Natal and contributes to 13 percent of furniture employment in the province.
- The manufacturer employs a total of 1100 employees.
- The manufacturer produces furniture at high volumes for the lower to middle income market, across the country.
- Automation is difficult in the furniture since most tasks conducted are non-routine manual in nature.

Furniture – Automation Initiatives

- Implementation of CNC routers instead of manual routers for furniture production.
- Employed two CNC technicians on a full time basis.
- Main reasons for automation: External competition from companies in South East Asia
 - E.g: quilting machine automation, visit to Vietnam
- Automation has enhanced the features of its products and created further employment.
 - One challenge is that smaller firms do not have the capital to automate and remain competitive.
 - For instance five small scale producers have had to shut down.

Furniture –Automation and Employment

- Automation not driven by cost savings, but rather to remain competitive.
- Various stages of production are associated with different probabilities of automation.
 - Automation is more likely at the fabric cutting stage of production, less likely at assembly because products are customised.
- If the plant were to increase automation to a maximum level (without monetary constraints) the estimated risk to employment would be 2.7% of all jobs at the firm.
- The manufacturer sees the furniture industry as labour intensive into the foreseeable future.

Furniture –Automation and Employment, NMW

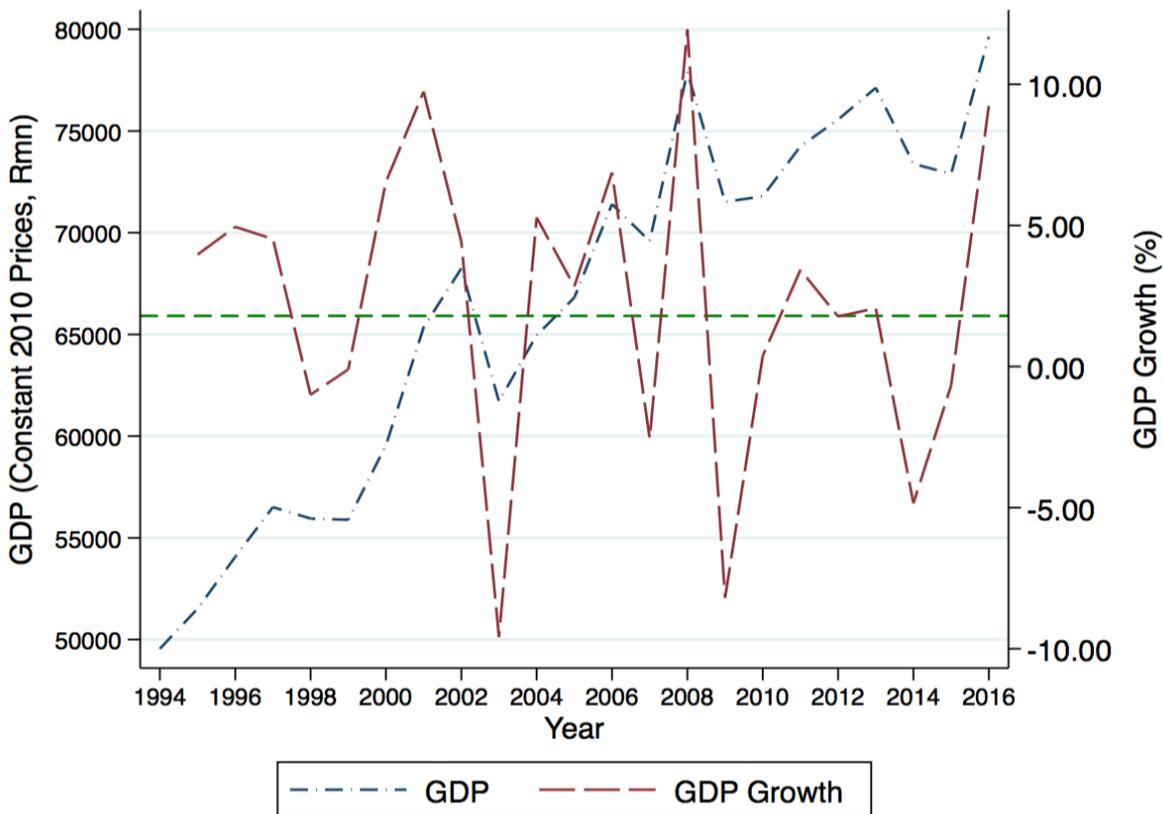
- Main risk to jobs does not come from automation, but a lack of automation forcing the manufacturer out of the market as exposure to imports increases.
- Requires increased funding from the DTI to remain competitive in an increasingly globalised market.
- The National Minimum Wage poses the risk of a steep increase in labour costs. As a result this manufacturer is looking into increasing automation to increase the efficiency of current production, whilst saving on labour costs. The intention is to increase the bottom line so that steep increases in wage do not lead to workers being let go.

Furniture – Future of Automation

- According to the manufacturer, over the next 10-15 years, the risk of jobs being replaced by automation is slim.
- This is because much of the products produced by the manufacturer are not homogenous.
- Essentially furniture is a fashion based industry and continual changes in design and various degrees of customisation coupled with low volume implies that full automation is not possible. Resultantly labour is always needed.
- Overall, automation has not led to any retrenchments thus far. It has had a minimal effect on new hires but has allowed for greater volume and lower cost production of goods at a “world class” quality.

Metals – An Overview

Figure 16: GDP and GDP Growth: Metals, 1994 - 2016



The real contribution of GDP has increased from R49.6 billion in 1994 to R79.6 billion in 2016.

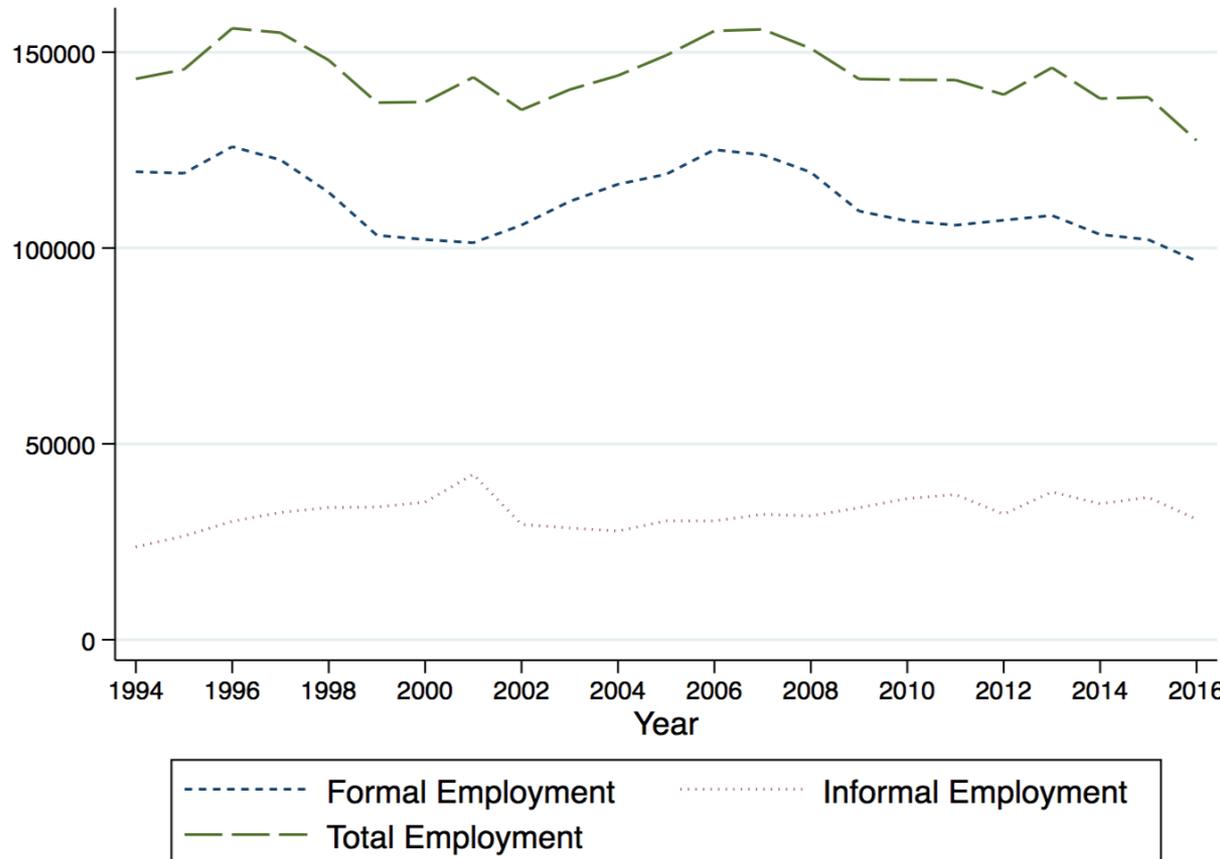
The year on year patterns of growth, however, have been slightly more volatile.

Most notable is the steep decline in the GDP growth of metals amidst the global recession of 2008 and 2009, at -8.2 percent.

This corresponded to a drop in the real contribution to GDP from R77.5 billion to R71.9 billion.

Metals – An Overview

Figure 17: Employment by Employment Type: Metals, 1994 - 2016



The number of workers in informal employment in metals has risen by 29.9 percent from 23 705 in 1994 to 30 783 in 2016.

The rise in informal employment saw quite a prominent spike in 2001, coupled with a simultaneous decline in formal employment in the same period.

The rise in informal employment and decline in formal employment could be the result of unpredictable demand, implying that firms prefer to hire informal workers that they can let go at short notice.

Metals – An Overview

Figure 19: Annual Real Wages and Real Wage Growth for Metals Workers, 1994 - 2016



There has been an upward trend in the average wage growth for metals workers of 49 percent between 1994 (R94 732) and 2016 (141 577).

Wages rose consistently between 1994 and 2002, but dropped dramatically by 13.6 percent from R117 901 in 2002 to R101 871 in 2003.

This drop may be associated with the rise in informal employees in the same period and high bargaining council engagement.

Metals – Case Study: Background

- A producer of inter-modal tank containers was interviewed.
- The producer, based in the Eastern-Cape, designs and manufactures custom made tank containers intended for logistical use in the transport of liquids.
- The manufacturer employs 1 600 individuals, and produces between 22 and 30 tank containers per day.
- The plant is classified as semi-automated, meaning that it produces output at a low to medium volume and exhibits repetitive (but customized) work.
- Principles of lean manufacturing are adopted by the firm and at present the firm has a number of automation initiatives under way.

Metals – Case Study: Automation Initiatives

- Most of the automation initiatives at the firm consist of adding robots to processes in the plant.
- Typical expenditure on automation covers the installation of flow lines and a semi-automation of processing equipment.
 - An example of this is the introduction of steam channel welding, which is a procedure set to automate the longest weld on tank containers.
 - Here, each tank requires a total of 110 meters of welding. Historically, this was done manually.
 - However, with a manual weld of this length there is large scope for inconsistencies as welders fatigue.
 - Introducing a robot to this part of the production line allows for an increase in the consistency of production.

Metals – Case Study: Automation Initiatives

- The introduction of automation on various parts of the production line is met with a redeployment of workers to other tasks.
 - The respondent noted that it is not ample to automate one part of the line only to be met with bottlenecks down the line.
- It is usually routine manual tasks that are automated at the plant. For instance, simple and predictable welds.
- The complexity and costs associated with handling, assembly and other non-routine tasks are associated with lower automation. E.G: fitments and ex-post adjustments to tanks after welds.

Metals – Case Study: Drivers of Automation

- There are three main drivers of the firm's decision to automate:
 1. The pursuit of higher quality production, quality improvement and quality consistency.
 2. Production efficiency improvements.
 3. Pressure from external competitors.
- The third factor is the most pertinent:
 - The falling away of SA export subsidies in the late 1990's coupled with the depreciation of the rand have hindered demand for SA tank containers.
 - The Renminbi is floating against the US dollar making Chinese replicas cheaper and more attractive to customers.
 - Further there are a large number of Chinese export subsidies available to Chinese producers.
 - Without automation product differentiation would not be possible.

Metals – Case Study: Impact on Hiring and Skills

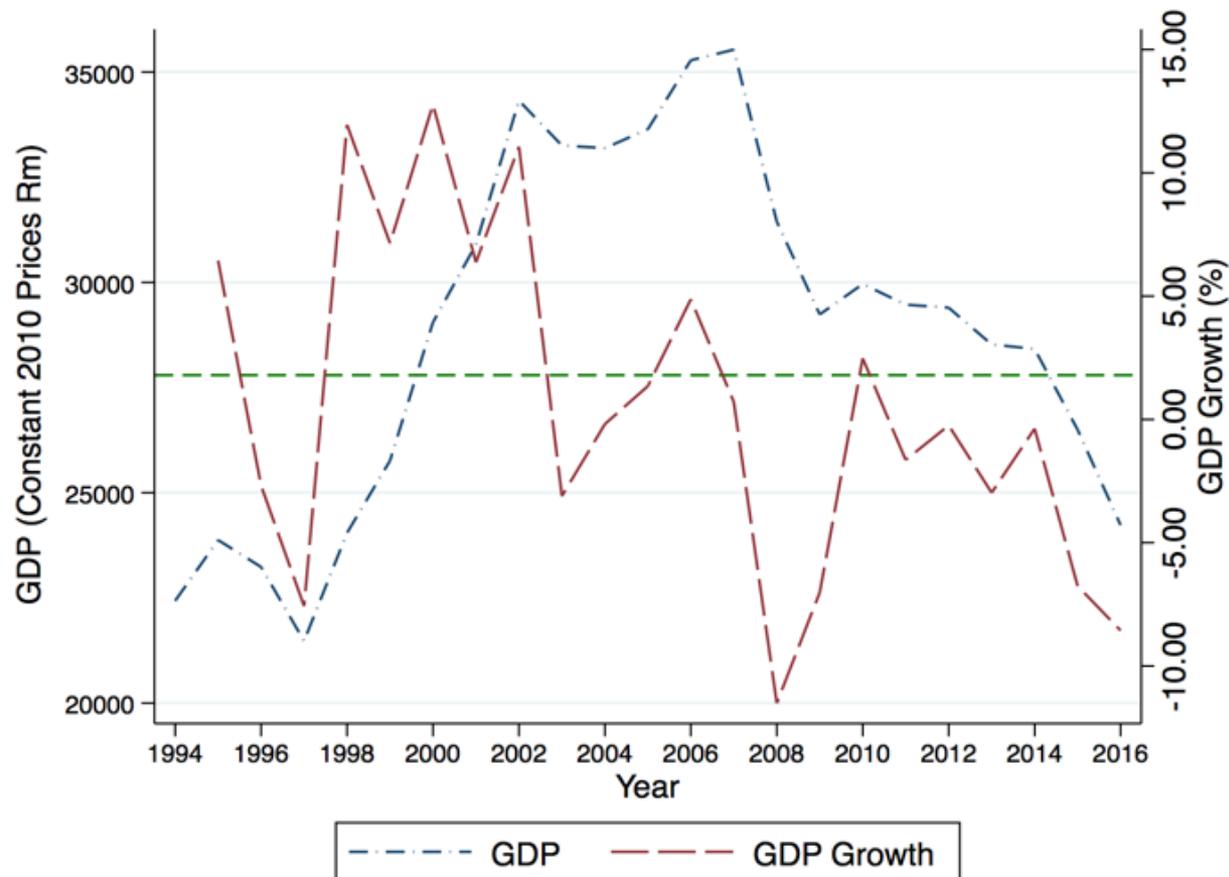
- At present automation initiatives at the firm are unlikely to lead to lay-offs
 - The firm invests heavily in the current labour force especially in terms of training and is reluctant to let workers go.
 - There are efficiencies to be gained by a redeployment of staff.
- The firm believes that the hiring pattern it will see in the future includes a hiring of more skilled workers coupled with a reduction in the number of lower skilled workers hired: Plateau effect.
- The impact on total employment over the next five years is limited.
 - For instance, of thirty seven employees involved in a process that was automated, seven (19 percent) were found to be redundant after the robot was installed but none were let go.

Metals – Case Study: Impact on Hiring and Skills

- In general the firm finds that automation is likely to only lead to a marginal upskilling of the current workforce.
 - Such upskilling includes once off training on how to operate robots.
- Semi-automation is likely to continue at the plant, at a pace that keeps current labour in place but does not make room for new hires.
- Automation is not motivated for because it is directly linked to increases in the profitability of the business,.
 - Instead it reduces deadweight loss, increases efficiency and maintains competitiveness.

Plastics– An Overview

Figure 21: GDP and GDP Growth: Plastics, 1994 - 2016

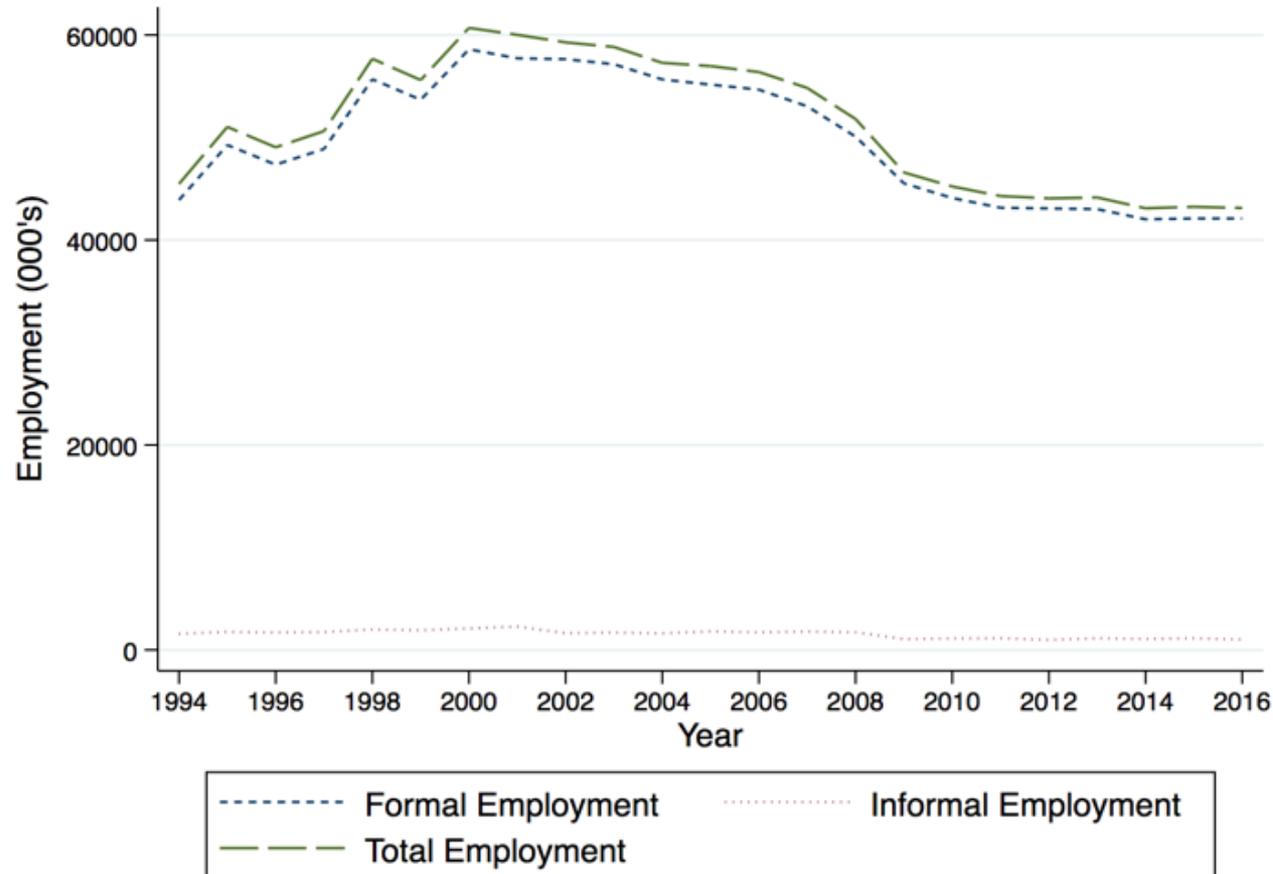


GDP in the plastics industry has followed an inverted-u shape since the mid 1990's. GDP increased to a peak of R35bn in 2006, and since then has decreased in contribution to R24bn in 2016.

GDP growth in the sector has been mainly negative after 2002.

Plastics– An Overview

Figure 22: Employment by Employment Type: Plastics, 1994 – 2016



The plastics industry consists mainly of formally employed workers, with a small percentage (1571 in 1994 and 1016 in 2016) active in informal employment

Plastics– An Overview

Figure 24: Annual Real Wages and Real Wage Growth for Plastics Workers, 1994 - 2016



While there has been a contraction in employment in the plastics industry real wages have been on an upward trend since 1994.

Real wage growth was negative in some years (2008 – recession and 2014).

Average annual real wages earned in 2016 are R223 247.

Plastics– Case Study

- To further gauge the impact of automation in the manufacturing sector, a plastics product producing firm was interviewed.
- The plastics firm has its main plant in the Western Cape of South Africa, as well as other plants in the Eastern Cape and other parts of the country.
- In total the firm employs between 3 500 and 4 000 employees, with the plant in the Western Cape accounting for 2 000 employees.
- The firm produces a number of rigid packaging plastic based products such as; containers, tubs (for yoghurt and ice-cream), bottles (for milk, water and juice), closures and preforms.

Plastics– Case Study

- At present, the plant is semi-automated with individuals positioned to operate the machinery at the end-line to complete the production process.
- There are eleven sub-plants on site at the factory that are all semi-automated. Automation is an ongoing process.
- In terms of automation procedures underway at present there are two main plans in place for the next year.
 - The first is the introduction of a machine that applies handles to four litre plastic bottles.
 - The second automation initiative underway is a sleeve applicator.
 - These applications are going to be automated to increase production efficiency.

Plastics— Case Study: Impact on Skills and Hiring

- More routine tasks tend to be automated since machines are able to complete tasks more efficiently than human counterparts.
 - However, with routine tasks not all are automatable:
Application of coat hangers post-production.
- The respondent foresees that automation is likely to result in a **plateau of hiring** in the near future.
 - That is, they are likely to see a reduction in new hires of both skilled and unskilled workers.
 - At the same time, however, large investments in training imply that the firm is unlikely to let current staff go.
 - Instead, current staff will be redeployed, as has been the case in the past.

Plastics— Case Study: Impact on Skills and Hiring

- The total quantum of staff affected by automation is estimated to be **around 8 percent**.
 - This includes redeployments.
 - To meet fluctuations in demand the firm is likely to make **increasing use of contract workers**.
- In terms of upskilling the firm notes that automation will only result in a small extent of upskilling.
 - This is mainly associated with training to operate new machines.
 - Many automation initiatives do not even require such training.
- Since the firm currently pays workers a wage in excess of the minimum wage its decisions to automate are not affected by the National Minimum Wage legislation.

Plastics– Case Study: Impact of Automation on the Business

- The main reasons this firm makes use of automation are:
 - Efficiency gains,
 - The pursuit of higher quality, higher volume production, and
 - Cost benefits
- External pressure or increased competition is not a determinant of this firm's choice to automate.
 - The nature of the product implies that it is not easily transportable. Thus it is easily able to meet demand within local markets.

Findings: Cross-Sectoral Analysis

Criteria	Furniture	Metals	Plastics
Plant Size	1 100	1 600	2 000
Proportion of female Employees	40 %	Still awaiting data	Still awaiting data
Skills Level of Labour Force	Mainly matric education	Mainly matric education and internal welding training	Mainly matric education with emphasis on mathematics and language
Current Level of Automation	Low to mid-level automated	Semi-automated, quite recently started increasing automation	Semi-automated.

Findings - Determinants of Automation: Cross-Sectoral Analysis

Determinants of Automation	Furniture	Metals	Plastics
Pursuit of Higher Quality Production	✓	✓	✓
Cost Savings	✓	X	✓
Increased production efficiencies	✓	✓	✓
Increased Market Demand	X	✓	X
Pressure From External Competitors	✓	✓	X
Introduction of the NMW	✓	X	X
Product Differentiation	✓	✓	X

Findings: Cross-Sectoral Analysis

Criteria	Furniture	Metals	Plastics
Future impact of automation on hiring	Low risk of jobs being replaced by automation as customisation is important in production	Low risk of jobs being replaced by automation as customisation is important in production, redeployment	Low risk of jobs being replaced by automation as staff are trained and redeployed
Proportion of workers affected by automation in the next five years (layoffs and redeployments)	30/1000 or 2.7 percent	Cited an example that indicated about 19 percent of jobs would be affected. But not sure.	8 percent
Future impact of automation on skills	No effect on skills. Defer to external hires to operate machines.	Marginal upskilling and sometimes training to operate machines	Marginal upskilling of workers to operate machines

Conclusion

- From these interviews it does not seem that there is a direct threat to current jobs, but instead over the next five to ten years we will see a **slowdown in hiring** as automation increases.
- Automation does not lead to a large upskilling of the workforce.
 - Workers are often just **redeployed** to other manual-routine jobs on the production line.
 - Where necessary skills will be brought in, but it is unlikely that such hiring will happen in large quantities.
- Automation is largely required to remain competitive but requires hefty capital outlays
 - An inability to remain competitive is the most imminent threat to jobs (Metals and Furniture are examples)
 - Need for incentive programmes to keep smaller participants competitive.

Thank you