

## *Innovation and employment growth in South Africa: Effects and implications*

### **Summary**

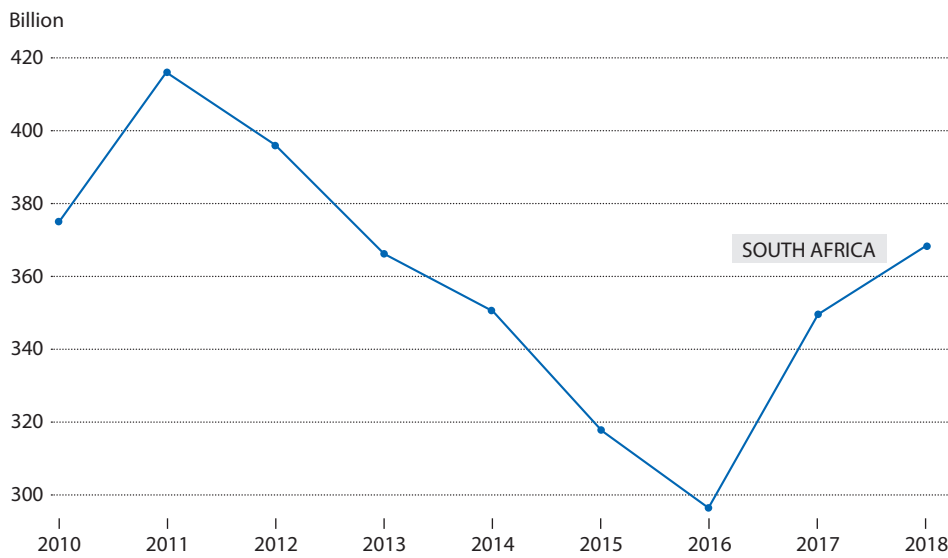
Previous studies have shown that innovation can influence employment growth at the business level. In the context of developing countries with high unemployment rates, innovations may, through technological advancements such as machine learning and artificial intelligence, have positive or negative effects on employment levels. As such, it is important to investigate the link between innovation and employment at the business level in contexts with high unemployment rates. This policy brief contributes to the discourse in the different policy domains — innovation policy, employment policy, skills development policy — by linking innovation to employment growth at business level, and by providing recommendations that may lead to the development of policy actions that are adaptive to the dynamic nature of innovation in South African businesses.

### **Introduction**

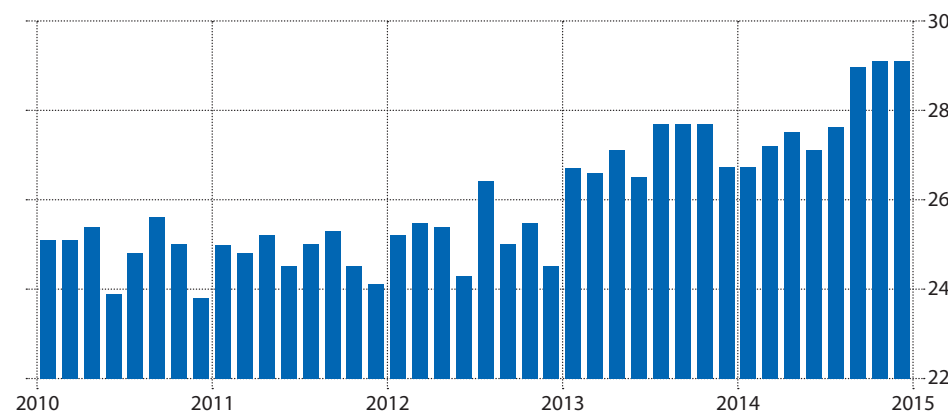
Over the past ten years, the developmental challenges of poverty, inequality, slow economic growth and high unemployment rates have intensified in South Africa. The

World Bank estimates the average unemployment rate for countries classified as upper-middle-income countries to be 6% (World Bank 2018; Yu 2017). South Africa's unemployment rate stood at 27% in 2018 and 29% in 2019 (Stats SA 2019; World Bank 2018). In contrast, one of its closest middle-income neighbours, Botswana, reported an unemployment rate of 18% in 2017 (Yu 2017). Despite numerous government initiatives and policy interventions, unemployment has continued to increase in South Africa. As illustrated in Figure 1, the Gross Domestic Product (GDP) (in billion US dollars) has declined year on year, with slight recoveries between 2017 and 2018. This poor economic growth has been accompanied by high levels of unemployment, as illustrated in Figure 2.

Innovation has been recognised as an important factor that contributes to business performance, competitive advantage and growth (Verspagen 2005). On a macro level, innovation has been shown to impact the economic development of countries positively (Hasan & Tucci 2010). Through the development of new or increased ranges of products (goods or services),



**Figure 1:** South Africa's declining GDP trajectory since 2011 (Source: World Bank 2018)



**Figure 2:** South Africa's 2010 to 2015 unemployment rate (Source: Trading Economics 2018; Stats SA 2019)

as well as the significant improvement of existing products, innovation helps businesses to grow. Financial outcomes of innovation include increased revenue or improved profitability. Innovation may also have strategic and marketing outcomes, enabling businesses to enter new markets, or increase market share.

However, innovation may have unintended consequences that could impact employment negatively. Rapid technological advancements, such as machine learning and artificial intelligence, may positively or negatively affect jobs. In the short term, these technologies may have negative effects as humans are 'replaced' by machines.

However, in the long run, the associated efficiency gains may be transferred to prices, leading to increasing demand, which may give rise to new jobs. Any net increase in unemployment levels is a major concern in countries with already high unemployment rates, such as South Africa. Therefore, understanding the effect of innovation on employment is of particular significance in South Africa.

This policy brief aims to illuminate the employment effects of innovation in South African businesses, based on an investigation of data from the national Business Innovation Survey (BIS) covering the period 2010 to 2012.

## The relationship between innovation and employment growth

Innovation can positively impact employment by creating new jobs, or can destroy existing jobs. The effects may differ, depending on the type of innovation. In general, process innovations aimed at saving costs – known as rationalisation innovations – are typically expected to have a negative impact on employment growth. This is primarily because fewer resources, particularly labour, will be required to produce a business's output. However, in the long run, such a 'productivity effect' may have a positive impact on employment growth, given that cost reductions may be transferred to output prices in order to improve production output. The resultant 'price effect' may stimulate demand, and, therefore, growth in jobs.

When it comes to product innovations, employment growth may be impacted positively by a high demand for new products, whether new to the business or new to the market. This is referred to as a 'demand effect'. However, the relationship between old and new products may also have positive or negative effect on employment growth. If the demand for both old and new products is high, logically, employment growth should increase, and vice versa. If there is an inverse relationship between old and new products, then the impact on employment growth is not easy to predict, because a number of factors may play a positive or negative role. These factors include, for example, the level of novelty of the new product, and the life cycle of the product or the sector. For new products that have not yet reached saturation stages of the product life cycle, for example, the demand for the new product will remain high (Vernon 1979; 1992).

The different types of relationships highlighted here are useful for examining the complex effects of

innovation on employment. The next section uses these relationships to present an empirical analysis for South Africa.

### How do innovations influence employment growth in South Africa?

Our empirical analysis explores the effect of innovation activities on employment in South African businesses, summarised in Table 1 and Table 2.

We first consider the effect of **product innovations** on employment growth. Both types of product innovations – new to the market and new to the business – have a positive effect (increasing employment) for the manufacturing sector, but no significant effect for the service sector (Table 1).

In contrast, **process innovations** have a negative effect overall, leading to a decrease in employment growth for both the manufacturing and service sectors. However, typically,

manufacturing businesses are expected to experience a negative employment effect from process innovations, because displacement effects outweigh compensation effects. Service businesses are typically expected to experience a positive effect, as they tend to react more aggressively, passing on to their prices only the productivity gains due to innovations. The data suggest that these effects are either not happening at all, or not happening fast enough to allow for a positive employment growth rate to be realised in South African service businesses.

The employment effect of process innovation is more complex, in that it differs between businesses that experience process-only innovation, and businesses that are both product and process innovators (Table 2). For both manufacturing and service businesses, process-only innovators have a positive employment growth rate, while product and process innovators experience negative employment growth.

There is no straightforward conclusion regarding the employment effect of rationalisation (cost reduction) process innovations compared to other process innovations. For process-only innovators, rationalisation innovations have a positive employment growth effect. However, other process innovations have a positive effect on employment growth for manufacturing businesses, but the opposite (negative effect) for service businesses.

For businesses that are both product and process innovators, rationalisation innovations have a negative employment growth effect. However, other process innovations have a negative employment growth effect for manufacturing businesses, but no significant effect for service businesses.

### Recommendations

With the advent of product and process innovations, the trend of (short-term) loss of jobs due to process innovations is expected to continue for both the manufacturing and service sectors. This raises a number of important questions for policy makers: What types of jobs are created due to product and process innovations? What types of jobs are lost due to process innovations? We do not yet have sufficiently fine-grained data to address these critical policy questions, but the data point to new directions.

**Table 1:** Effect of product innovations on employment growth for South African businesses, 2010–2012

Sector	Novelty		Overall
	New to Market	New to Firm	
Manufacturing	Positive/increasing effect (0.202–0.273) <sup>a</sup>	Positive/increasing effect (0.177–0.262)	Positive/increasing effect (0.178)
Services	No significant effect	No significant effect	No significant effect

a On average, a 1% increase in sales growth rate from products new to the market corresponds to employment growth rate ranging between 0.202 and 0.273%.

**Table 2:** Effect of process innovations on employment growth for South African businesses, 2010–2012

Sector	Process-only innovators			Product and process innovators			Overall
	Process intended to reduce costs	Other process innovations	Total	Process intended to reduce costs	Other process innovations	Total	
Manufacturing	Positive/increasing effect (0.257–0.390) <sup>a</sup>	Positive/increasing effect (0.377–0.508)	Positive/increasing effect (0.427–0.646)	Negative/decreasing effect (0.237–0.353) <sup>b</sup>	Negative/decreasing effect (0.165–0.260)	Negative/decreasing effect (0.209–0.461)	Negative/decreasing effect (0.451–0.605)
Services	Negative/decreasing effect (0.438–0.451)	Positive/increasing effect (0.346–0.712)	Positive/increasing effect (0.221–0.617)	No significant effect	Negative/decreasing effect (0.225–0.439)	Negative/decreasing effect (0.446–0.504)	Negative/decreasing effect (0.556–0.567)

a On average, for process-only innovators, having process innovations intended to reduce costs corresponds to an increased employment growth at the business level ranging between 0.257 and 0.390%, compared to not having these innovations.

b On average, for product and process innovators, having process innovations intended to reduce costs corresponds to a decreased employment growth at the business level ranging between 0.237 and 0.353%, compared to not having these innovations.

First, our analysis illustrates that the effects of innovation on employment at the business level are complex, depending on the types of innovation. Second, it emphasises that there are distinctive effects in the manufacturing and services sectors.

The data reinforces the need for government departments to work together with other stakeholders such as unions and the business sector as well as higher education institutions to balance the need for innovation and its effects on employment and skills development.

The patterns in data suggest where efforts may be usefully concentrated and which types of innovations may potentially lead to positive effects on employment. Therefore, we recommend that policy makers should develop policies aimed at encouraging more product innovations by facilitating easy access to stimulus mechanisms for those businesses that produce innovations which result in job creation. One such stimulus mechanism is a tax incentive, but the data suggests that we need to be more creative in identifying new forms of incentives to stimulate innovations that can have positive effects.

The trends in the data also have implications for skills development and raise further policy questions such as: Does South Africa have the necessary skills for the jobs created due to product and process innovations? Do these jobs for which the country experiences skills shortages require training or skills importation? It is evident that further research is required to provide more robust evidence on the type of jobs that are lost or created as a result of innovations.

## Acknowledgements

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## References

- Hasan I & Tucci CL (2010) The innovation–economic growth nexus: Global evidence. *Research Policy*, 39(10), 1264–1276
- Sithole MM & Buchana Y (2020) Effects of innovation activities on employment growth in upper-middle-income countries with high unemployment rates. *Development Southern Africa*, 1–20
- Stats SA (2019) *Quarterly employment statistics*. Accessed 17 November 2020, <http://www.statssa.gov.za/?p=10530>
- Trading Economics. (2018). *South Africa's unemployment rate*. Accessed 17 November 2020, <https://tradingeconomics.com/south-africa/unemployment-rate>
- Vernon R (1979) The product cycle hypothesis in a new international environment. *Oxford Bulletin of Economics and Statistics*, 41(4), 255–267
- Vernon R (1992) International investment and international trade in the product cycle. In J Letiche (Ed.) *International economic policies and their theoretical foundations* (2nd edition) (pp. 415–435). Academic Press
- Verspagen B (2005) Innovation and economic growth. In *The Oxford Handbook of Innovation*. doi: 10.1093/oxfordhb/9780199286805.003.0018
- World Bank (2018) *Data Bank Microdata Data Catalog: Upper middle income*. Accessed 15 April 2018, <https://data.worldbank.org/income-level/uppermiddle-income>

Yu D, The lesser known and scarier facts about unemployment in South Africa. *Mail & Guardian*, 4 September 2017. Accessed 4 August 2017, <https://mg.co.za/article/2017-09-04-the-lesser-known-and-scarier-facts-about-unemployment-in-South-Africa>

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