



7.1 INTRODUCTION

The limited structural growth of South Africa's economy has led to dismal performance in the reduction of unemployment and poverty over the last decade. This study has analysed and acknowledged the role of the broader agricultural sector (i.e. the agro-complex) in economic development and growth. Hence, the main aim of this study was to identify pathways of growth within South Africa's agro-complex based on the rationale that these need to be informed by the country's current capabilities and driven by structural transformation, employment creation and market demand. The product space methodology was used to analyse South Africa's current productive structure and its prospects for diversification based on these three drivers at product-level.

In Chapter two a review of literature was conducted to provide some theoretical background on the theories of growth with a special focus on the role of intentional trade, diversification and the agricultural sector therein. Chapter three broadly analysed South Africa's agricultural sector, both in an international and national context, and specifically investigated the sector's trade performance along the lines of four margins of growth. In Chapter four the methodological framework for the product space analysis and the identification process of diversification pathways were laid out. Chapter five specifically analysed the structure of the agricultural product space and the position of South Africa in the network. Chapter six identified product-level diversification opportunities based on upgrading (i.e. structural transformation), local and international market demand, and labour absorption and quality. This chapter provides a summary of the study, followed by the main findings and implications and finally ends with recommendations.

7.2 SUMMARY

7.2.1 *Background and objectives of the study (Chapter 1)*

Unemployment and poverty are rooted in South Africa's limited economic growth and structural transformation. Growth levels can only improve through producing and selling



more products. In the same vein, structural transformation can only take place by producing different and more advanced products. This study departs from the notion that the broader agricultural and food sector – the agro-complex – has an unmistakable role to play in these processes.

The sector is an important earner of foreign currency, as many of its products have found their way to a variety of international markets. However, the sector's reliance on a narrow export base of mainly primary agricultural products makes it vulnerable to external shocks. South Africa's export basket of mainly agricultural export products has not changed significantly over the last three decades. Apart from some exceptions (e.g. wine), limited transformation has taken place with regard to its agricultural product portfolio. Furthermore, the country is relatively reliant on imports for its supply of mainly processed agricultural and food products. Hence, some structural changes have to take place, not only to widen its production portfolio, but also to boost existing exports and improve on the value adding capabilities. This will ultimately enhance the sector's contribution to long-term economic development and higher levels of growth.

Accordingly, the motivation for this study is the state of South Africa's structurally low growth levels and unemployment and the concept that the agro-complex has a contribution to make in addressing these challenges. It is envisaged that the way forward is to unlock the diversification potential from the agro-complex. Hence, three strategic values were identified to investigate this potential, namely structural transformation, market-driven diversification, and employment-driven diversification.

Against this background, the primary objective of this study was to establish the role of the broader agricultural sector in South Africa's future economic development by identifying diversification pathways for growth and employment within the agricultural product space. The secondary objectives of the study are listed in Table 7.1, together with an indication in which part of this study these have been addressed.

**Table 7.1: Meeting the objectives**

Objective	
Provide a theoretical background on the links between economic growth and international trade, agriculture and diversification	Chapter 2
Provide a background on South Africa's agro-complex from an international and national perspective	Chapter 3
Provide a background on South Africa's performance of international trade from its agro-complex	Chapter 3
Develop a methodological framework for identifying diversification pathways in the agricultural product space	Chapter 4
Construct and visualise the agricultural product space	Chapter 5
Analyse the structure of the agricultural product space and the linkages between the different clusters of the agro-complex	Chapter 5
Determine and analyse South Africa's position in the agricultural product space	Chapter 5
Determine South Africa's diversification pathways for structural transformation in the agricultural product space	Chapter 6
Determine South Africa's market-driven diversification pathways in the agricultural product space	Chapter 6
Determine South Africa's diversification pathways for employment creation in the agricultural product space	Chapter 6

7.2.2 Theories of growth (Chapter 2)

The rationale for economic growth and the role of diversification, international trade and agriculture therein were discussed in Chapter two. This provided a theoretical foundation for the approach of this study.

The question on why some nations have performed better economically than others has received much attention and debate for decades. Chapter two starts with a historic overview of the most important growth theories, ranging from the Mercantilists to the Classical Growth Theories, to more recent contributions by Endogenous Growth Models. Subsequently, a number of modern growth theories were highlighted, such as Porter's (1990) concept on the competitive advantage, Nell's (1998) theory of transformational growth, Milanovic's (2003) arguments for globalisation, and Rodrik's (2005) notion on institutional reforms.

A number of empirical studies on economic growth were also reviewed, which revealed that very few variables are robustly correlated with growth, apart from human capital and investment. Most past growth theories have looked at the differences in factor



endowments, institutions and technology. Some new theories have investigated economic development by means of the actual goods produced. They show that *what* products a country produces or exports matters for growth. The notion is that every product requires a unique set of capabilities (e.g. institutions, resources, supply chains, and knowledge) and that the competencies and the related level of development of a country depend on the set of capabilities it has. In this theory, economic development and growth is led by structural transformation by upgrading a country's productive structure towards related and more sophisticated products.

In Chapter two, a review of the literature on the role of agriculture, international trade, and diversification in economic development was also discussed. Those aspects comprise the scope of this study and for each of these their specific impacts on economic growth and employment were investigated.

7.2.3 South Africa's agricultural sector and trade (Chapter 3)

Chapter three provided background on the performance of South Africa's agro-complex and its international trade flows. This discussion provided a baseline of the sector's current strengths, weaknesses and opportunities for future growth as analysed in Chapter six.

Firstly, the chapter investigated South Africa's agricultural sector in a global context. A number of trends in global agriculture were discussed. Subsequently, South Africa's agricultural sector was benchmarked against a selected group of 17 countries on a variety of agricultural indicators. These indicators included amongst others: total agricultural area, total output, agricultural population, yield gaps, land productivity and agricultural employment.

The second section of Chapter three also analysed the agricultural sector from a national perspective by comparing it with South Africa's other economic sectors. The sector was introduced in terms of its dualistic nature and important changes over time. Subsequently, a brief analysis of the country's agricultural resources in terms of agricultural land use and land capabilities was provided. This section also investigated the contribution of the sector



to the national economy and its growth as well as its back- and forward linkages with other economic activities.

The provision of food is the agriculture's sector single most important contribution in socio-economic terms and therefore the trends in its output, productivity and structure were investigated. South Africa's agricultural sector is also an important earner of foreign currency as many of its products have found markets around the globe. Hence, the sector's trade orientation was compared with that of other sectors as well as its long-term trends in exports, imports and trade balance.

The composition of employment in agriculture as well as its long-term trends was also discussed. Agriculture has an important role to play in food security, which is currently high on the country's development agenda. Therefore, a brief analysis of the self-sufficiency ratios was given and provided some stylised facts on household food security and the regional demand for food. The section ended with a discussion of the policy context which shapes today's agricultural sector.

Section three of Chapter three focussed on the trade performance of South Africa's agro-complex. This analysis largely followed the framework as laid out in the World Bank's Trade Competitiveness Diagnostics Toolkit by Reis and Farole (2012). This framework implied the decomposition of trade growth into four margins; namely the intensive margin, the extensive margin, the quality margin and the sustainability margin. The intensive margin comprises of existing trade flows as where the extensive margin entails the diversification of products and markets. Furthermore, the quality margins investigate the composition of trade in terms of its level of technology intensity and sophistication as where the sustainability margin decomposes the export-relationships and analyses the gap between factor intensities of products and the country's endowment levels.

In order to provide some benchmarking of South Africa's trade performance eight peer countries were objectively selected, namely: France, USA, Thailand, Argentina, Brazil, Chile, Australia and India. The product scope of the analysis was also determined by the selection of 1 456 products at the HS6 level that comprise the total agro-complex. These were



categorised in clusters, namely: primary agriculture (221 products), agro-processing of food (522 products), agro-processing of non-food (413 products), forestry (222 products) and agricultural inputs (78 products).

From this trade performance analysis, four channels of future growth in the agro-complex were identified, namely: substitution of re-export by local production, production of new export products, import-substitution of large imports, and market diversification of existing exports.

The conclusive section of Chapter three provided some perspectives on agricultural growth in South Africa. The potential for the expansion for agricultural production was briefly discussed as well as the country's desired growth path and a synopsis of the directives for agriculture as postulated in the National Development Plan.

7.2.4 Methodological framework (Chapter 4)

The outset of Chapter four provided theoretical background as well as the methodology of the product space concept. This concept is the basis for the identification of diversification pathways in South Africa's agro-complex and the subsequent parts of the chapter provided the empirical frameworks for the three strategic values, namely: structural transformation, market driven diversification and employment driven diversification.

The relatedness of products on the basis of similarities of embedded production capabilities is conceptualised in the product space concept. A measure for the proximity between products was presented and used to map the relatedness of products in a network visualisation; the so-called "product space". The position of a country in this network, whether in the sparser or denser parts, can predict the easiness with which a country transforms itself economically in producing more complex products. This process of transformation is not an endogenous process, but is led by market-, social-, and policy incentives. These incentives are embedded in the three strategic values for diversification.



The process of structural transformation in the product space is informed by the potential to move (i.e. upgrade) to “new” more complex products. Hence, chapter four provided an empirical framework on the determination of the degree of embedded complexity of products. Furthermore, the *Opportunity value*, a measure for the closeness of new and more complex products relative to a country’s current productive structure was developed. A measure to identify longer-term upgrading opportunities was also developed, namely the *Opportunity outlook*.

Chapter four commenced with the methodological framework used to inform market-driven diversification opportunities within the agro-complex. This framework includes the *Decision Support Model* (DSM) for identifying realistic export opportunities and was applied for identifying potential new exports as well as market diversification of existing exports. These are two of the four channels for potential growth within the agro-complex, as identified in chapter three.

A measure was developed to link the export opportunities of the DSM and the diversification pathways in the product space, namely the *Export opportunity value*. Furthermore, the number and potential value of market diversification opportunities as identified by the DSM analysis was linked to South Africa’s existing production.

The opportunities within the product space for the two other identified growth channels, namely import-substitution and substitution of re-exports, were identified by the application of two constructed measures. These are the *Import-substitution opportunity value* and the *Substitution opportunity value*.

The last part of Chapter four discussed the methodology for identifying employment driven diversification opportunities within the agro-complex. This is a second-level imperative as the capitalisation of diversification opportunities needs to be driven by market incentives. Moreover, no employment creation will occur without substantial growth in supply and demand.



The potential quantity of employment creation was measured by calculating the *Labour intensity index* for 25 agricultural sub-sectors and linking this at product-level. This index was then used to develop the *Employment opportunity value* which identifies the diversification opportunities for the products in the product space with the highest employment creating potential.

The quality of employment was measured by using the detailed product-level *Revealed Human Capital Intensity Index*. This index was subsequently used to develop the *Human capital opportunity value* which measures the human capital intensity of South Africa's unexploited prospects in the agricultural product space.

7.2.5 The agricultural product space (Chapter 5)

Chapter five provided the first stage of the results of the analysis of diversification pathways and comprised of an overview of the structure of the agricultural product space and South Africa's location therein. A product space was constructed using the same product scope as in chapter three, namely 1 456 products defined at the six-digit level of the Harmonised System. These products comprise the agro-complex and were divided in five broad product clusters as discussed in chapter three.

The chapter commenced with the construction of the *Proximity matrix*. This 1 456-by-1 456 matrix presents all the possible product to product relationships within the agro-complex. This amounted to a total of 797 265 relationships and total of 1 392 products with some degree of relatedness. The *Proximity matrix* was used to construct and visualise the agricultural product space network using the NodeXL software package for MS Excel. This initial network was colour coded in accordance with the product's classification under the two-digit level of the Harmonised System (HS) nomenclature. The location of the five broad clusters of the agro-complex was also plotted in the agricultural product space. The degree of inter-cluster relatedness (i.e. horizontal linkages) was analysed as well as the intra-cluster relatedness (i.e. vertical linkages).



The next part of Chapter five analysed South Africa's position in the agricultural product space which is the starting point for possible diversification ventures within the product space network. This position is based on the country's current productive structure in the agro-complex as revealed by the product-level RTA indices. Based on this index a distinction was made between products in which South Africa has either a low- or high level of specialisation. Diversification opportunities originating from the core competencies are regarded as "low hanging fruits" since the capabilities embedded in the core competencies are well-developed and relatively easier to transfer to "new" products.

The intra-cluster relationships of South Africa's core competencies in the agro-complex were analysed to investigate the potential for local value adding through vertical linkages. At a product-level the analysis of connectedness of South Africa's core competencies within the agricultural product was investigated. This connectedness indicates the potential to diversify to nearby "new" products in the network.

The final part of Chapter five analysed whether a product is connected to South Africa's productive structure in the agro-complex and how "far" this product is located from this structure by using the measure of *Distance*. This analysis revealed the total number of diversification opportunities in the agricultural product space that can be "reached" from the country's core competencies as well as from its overall productive structure.

7.2.6 Pathways of diversification (Chapter 6)

Chapter six provided the second part of the analysis of the diversification pathways based on the agricultural product space as presented in chapter five. This chapter provided the results of the analysis of the three strategic values, namely: structural transformation, market driven diversification and employment driven diversification within South Africa's agro-complex.

In its introduction the chapter started with an analysis of the diversity of South Africa's agro-complex in terms of the variety of products it produces. A comparison was made between



South Africa and 116 peer countries on the basis of their level of economic development and agricultural diversity.

The first strategic value that was analysed was structural transformation in section two. This entails the potential for upgrading of the country's current productive structure in the agro-complex by diversifying into products with a higher level of complexity. The notion of complexity is the intensity of knowledge, technology and quality of institutions associated with higher levels of productivity.

The compound level of complexity in the agro-complex was estimated by calculating the *Agricultural Complexity Index (ACI)* for 116 countries. The relationship between the *ACI* and the level of economic development of those 116 countries was analysed. The product-level complexity in the agro-complex was investigated by calculating the *Product Complexity Index (PCI)* for all of the 1 456 products that comprise the agro-complex. This measure was used to analyse the differences of complexity of the five clusters of the agro-complex.

The chapter furthermore analysed the contribution of the clusters included in the agricultural product space to the total global trade in the agro-complex. This provided a good indication of the relative significance of the products under investigation.

The chapter continued with investigating the distribution of the overall level of complexity at product level in order to provide a ranking of the top and bottom most complex products in the agro-complex. An analysis of the level of complexity of specifically South Africa's exports and imports within each of the cluster of the agro-complex was also conducted. This was to provide a perspective on South Africa's terms of trade with regards to complexity levels.

A ranking exercise that showed the overall the complexity of South Africa's core competencies in the agro-complex, was conducted. This was supplemented by an analysis of the gap between South Africa's level of complexity within each cluster and the average level of complexity of all products within those clusters. This provides an indication of the relative position of the complexity of the country's clusters in the agro-complex as well as the room



for improvement. However, the potential for closing the gap largely depends on the “distance” to current production of the diversification opportunities within each cluster.

In order to identify the diversification opportunities in the agricultural product space with the highest potential for upgrading (i.e. structural transformation) the *Opportunity value* was calculated. This measure was used to draw an opportunity network of South Africa’s core competencies which showed the inter-linkages between the different diversification opportunities. These inter-linkages indicate the possibilities for conjoined upgrading ventures. Section two also provided an overview of South Africa’s upgrading opportunities with regards to the number of opportunities per cluster as well as the average distance to its productive structure. A shorter distance implies a higher simplicity with which a country can diversify to new “products”.

All of South Africa’s upgrading opportunities were ranked in a table according to the *Opportunity value*. This ranking also provided the origin within the country’s core competencies of each upgrading (diversification) pathway. Furthermore, for each opportunity its strategic value was determined which was based on whether or not the product has a higher *PCI* than the average of its respective cluster. Opportunities with a strategic value have a higher contribution to structural transformation. At last an indication on whether there exists a direct or indirect productive relationship between the origin and the upgrading opportunity was given. Products from different clusters or sub-sectors were marked as having an indirect relationship as the transfer of capabilities is not as straightforward in those cases.

The opportunity networks that were presented earlier in the chapter were also further investigated in order to identify network communities. This was done by applying a clustering algorithm to the network. This analysis thus showed the possibilities for the capitalisation of interrelated upgrading ventures in which a number of diversification opportunities are targeted simultaneously.

The final part of section two of Chapter six investigated the strategic prospects for long-term upgrading opportunities. The “first-round” upgrading opportunities directly related to



the county's productive structure, as discussed in the first part of the section, also open up further so called "second-round" upgrading opportunities. Therefore, the *Opportunity outlook* was calculated which quantified the proximity of each "first round" upgrading opportunity to more complex products which are not currently connected to a country's productive structure in the product space.

The third section of Chapter six investigated the opportunities for market-driven diversification of the agro-complex within the product space. Where structural transformation is important for long-term economic development, this specific strategic value is an important driver for firms to diversify and is directly linked to production growth. The section elaborated the analysis of global demand in the beginning of this chapter by looking specifically at products and analysing their position in the agricultural product space.

The subsequent part of this section provided some stylised facts of the results of the Decision Support Models (see section 7.2.4) for the agro-complex. Firstly the export opportunities of the five clusters were investigated in terms of the potential export value as well as the average number of export markets from existing vs. new products. The geographical distribution of the export opportunities in the agro-complex was also shown.

Chapter three already indicated a high variety of exports but also a large proportion of re-exports. Further analysis of the diversification of the country's production specifically, which provides a much better reflection than exports in terms of the variety of a country's embedded capabilities, was conducted in Chapter 4. The proportional variety in production was compared with the variety of exports in order to estimate the proportion of re-exports.

The first potential growth channel for market-driven diversification within the agro-complex, as identified in chapter three, was the substitution of re-exports by local production. Firstly the re-exports that are directly linked to South Africa's core competencies were identified and plotted in the agricultural product space. Subsequently, the *Substitution opportunity value* was calculated to identify those re-exports with the highest potential for substitution. These opportunities were ranked and also evaluated based on their strategic value in terms of their total potential export value.



The second growth channel that was identified for market-driven diversification was the production of new exports. The *Export opportunity value* was calculated for all diversification opportunities from both the core competencies and the overall productive structure. The potential new export products were plotted in an export opportunity network. The top 15 products based on the *Export opportunity value* were ranked.

Import-substitution was identified as the third channel for market-driven diversification. It was emphasized here that only import products which are closely related to current production can be competitively substituted by local production. Furthermore, the value of imports needs to be substantial in order to justify substitution ventures. This was assured by applying selection criteria. Subsequently, the *Import-substitution opportunity value* was calculated to identify the best opportunities for import-substitution.

The fourth growth channel for market-driven diversification was the market diversification of existing export products. Chapter three showed that within the extensive margin of the agro-complex the only significant export growth since 2002 was derived from existing products to new markets. The results from the DSM showed to how many additional markets the existing products could be exported as well as their total potential export value to these new markets.

The fourth section of Chapter six analysed the opportunities for employment-driven diversification. As mentioned in Chapter four this is a second-round imperative as employment is not created by diversification itself but by growth in production resulting from a market incentive. This section commenced with some stylised facts on the broad employment structure within South Africa's agro-complex.

This fourth section further investigated two dimensions of employment, namely quantity and quality. The quantity was analysed using the product-level *Labour intensity index*. The average labour intensity in each cluster was analysed as well as the labour intensities for the exports and imports in each cluster.



The product-level labour intensity was plotted in the agricultural product space and the distribution of the more labour intensive products in the network was determined. Subsequently the *Employment opportunity value* was calculated which identified the diversification opportunities of the products in the product space with the best prospects for employment creation.

Since the labour intensity is measured as a ratio to R 1 million of output, the results were put in perspective. This was done by analysing the unit values of the products within the agro-complex since this provides an indication of the number of product units needed to create R 1 million of output. It was envisaged that a relative low level of labour intensity could be offset by a high product value.

A ranking was made of all diversification opportunities in terms of their respective employment opportunity value. All of these products were also classified according to whether their product value is low, medium or high. If the product has a higher labour intensity then the average of its cluster it was identified as having strategic value.

The next part of section four investigated the level of human capital within the agro-complex. This is thus the quality dimension of employment as a higher level of human capital implies higher-skilled and better jobs. The product-level Revealed Human Capital Index (RHCI) was used to analyse levels of human capital in the agro-complex. The gap between the product-level human capital intensity of production and the country's levels of human capital endowment was also analysed. If a gap is revealed, it puts significant strain on the sustainability of production and exports of these products. Hence, diversifying to products which embed a high level of human capital is not that evident in South Africa's current labour environment.

Subsequently, the levels of human capital were plotted in the agricultural product space in order to analyse the distribution of the human capital intensive products in the network. The *Human capital opportunity value* was calculated to identify those diversification opportunities closely located to existing production and with the highest human capital intensity. A ranking was made of all diversification opportunities according to their



respective *Human capital opportunity values*. An indication of the sustainability of these opportunities in terms of their relative position to South Africa's current human capital endowment was also made.

The final section of Chapter six provided a consolidation of the outcomes of the analysis of the three strategic values for diversification. The section argued that the prioritisation of the three strategic values depends on the different objectives of economic stakeholders. Hence, from a government perspective priority would be given to structural transformation, from a private sector perspective priority would be given to market-driven diversification and from a socio-economic perspective priority should be given to employment creation. Finally a consolidated score was calculated to rank the diversification opportunities according to all three strategic values. An equal weighting was allocated to each of them.

7.4 CONCLUSIONS

The previous section provided an extensive overview of the study. This section will elaborate further on the findings, outcomes, implications and the contributions of this study.

7.4.1 *Findings, outcomes and implications of each research objective*

The main findings and implications with regards to the analysis of diversification pathways for growth and employment in the South Africa's agricultural product space are provided by summarising them for each of the ten research objectives of the study.

i. Provide a theoretical background on the links between economic growth and international trade, agriculture and diversification:

- Past growth theories have emphasized the role of differences in factor endowments, institutions, human capital, technology and competitiveness. These aspects all comprise the production capabilities embedded in a country's productive structure as stipulated by the product space concept.



- Economic development and growth is led by structural transformation by upgrading a country's productive structure towards related and more complex products.
- Agriculture has an unmistakable and important role to play in economic development in terms of the division of labour, food provision, strong intra-economic growth linkages, high labour intensity, rural poverty alleviation and earning foreign currency.
- International trade has both a variety of static and dynamic gains for economic development of which the distribution of income from trade is the main challenge for pro-poor growth.
- Trade liberalisation alone is not a sufficient condition for economic growth; reducing supply side impairments will have much larger effects.
- Employment effects of international trade are not conclusive since country-specific and endogenous factors play a significant role (e.g. terms-of-trade, labour policies, human capital).
- Diversification of trade can be an important driver for economic development in terms of increased resilience to external shocks, the accumulation of new technology and knowledge, structural transformation by producing more complex products, the substitution of imports and increased local valued adding.
- Diversification is positively linked to economic growth; however, most of this growth is generally derived from exporting existing products to new markets.
- Firms tend to diversify to related products but relative few of them are new to the country

Implications:

As mentioned in chapter one, the three strategic values for growth that were identified for South Africa's agro-complex, namely: structural transformation, market-driven diversification and employment-driven diversification address the country's current challenges of sluggish economic growth, limited economic diversification and high unemployment. The implications of these findings are that these strategic values, especially within the scope of the agro-complex, all have a sound theoretical foundation.



ii. Provide a background on South Africa's agro-complex from an international and national perspective:

- Increased pressure on food security from global population growth, especially in Africa, will put pressure on land use and created a renewed focus on the importance of agriculture.
- South Africa is generally a price-taker in agricultural niche markets.
- The country has relative strong linkages with global markets.
- The country has a relative large agricultural area combined with relative low levels of land productivity due to agro-climatic constraints.
- Fifteen per cent of agricultural area is suitable for crop production and 85 per cent is suitable for grazing.
- The country has positive yield gaps exist for many crops in a global context due to the adaption of sound management and technology practices.
- South Africa has a relative large agricultural population; thus a large dependency on agriculture.
- The dualistic nature of South Africa's agricultural sector with a skewed policy focus towards developing farmers.
- The commercial farms are dominated by SMME's.
- There are five times more small-scale famers (excluding subsistence farming households) then commercial farmers
- Agricultural market reforms have resulted in increased opportunities and threats from globalisation.
- Difficult agro-climatic conditions in large parts of South Africa require the sustainable use of resources.
- Small proportion of agricultural area is high-potential crop land which increases pressure for the intensification of production on medium and marginal potential cropland.
- Potential exists for increasing irrigation and cultivation of medium- to high potential land in the former homelands.
- Combined contribution of primary and secondary agriculture is slightly smaller than the mining sector.



- Poultry, cattle and maize are the most important contributors to primary agricultural production.
- Sixty-six per cent of primary agricultural output is used in other sectors which implies that growth in primary agriculture is strongly dependent on growth in other sectors.
- The agricultural balance of trade is deteriorating.
- Employment in the agro-complex larger than in mining, transport and energy sectors.

Implications:

These findings confirm that the role of the agro-complex in South Africa's growth path should not be marginalised. The sector is relatively well-developed but shows some areas for improvements mainly in the domains of policy and innovation in order to further unlock its potential.

iii. Provide a background of South Africa's performance of international trade from its agro-complex:

- The definition of the agro-complex is based on 1 456 products classified at the six-digit level of the HS nomenclature, which subsequently are categorised in five broad clusters, namely: primary agriculture, agro-processing of food, agro-processing of non-food, forestry, agricultural inputs.
- South Africa has a relative open economy and well integrated into global markets.
- The country has a low share of agriculture in total exports compared to even the developed countries.
- South Africa has a high reliance on imports of agro-processing of food and non-food products as well agricultural inputs.
- A diminishing export specialisation and increasing import specialisation in the agro-complex since 2002.
- A small majority of exports of primary agriculture have a revealed competitiveness within the other four clusters the proportion of exports with a revealed competitiveness is relatively small.
- The growth orientation in terms of export products is fair, but good in terms of export markets although there is room for improvement.



- The export market penetration is still relatively low implying a relatively large number of unexploited markets.
- There was a steep increase in the number of export markets since 2002; 65 per cent of export products reach a minimum of 10 markets.
- Export market concentration declined significantly since 1976, but increased slightly since 2008.
- Eastern Africa surpassed the EU as most important export region.
- There exist potential for improving the export diversification for especially the primary agriculture, forestry and agro-processing of non-food cluster.
- South Africa experienced no major shifts in top export products from the agro-complex since 1976 apart from wine.
- The increasing export specialisation over the last years may be a sign of maturity in economic development or an increased reversion towards traditional exports.
- Most of the export growth in the extensive margin will have to come from exporting existing products to new markets.
- The negative trade balance for at least half of the export products from each cluster implies a large proportion of re-exports.
- The country's level of specialisation is higher in less sophisticated products
- There exist relative large gaps between the human capital intensity of its exports and the country's human capital endowment.
- Most of the export growth since 2002 was derived from existing products to existing markets although a significant amount of existing export products to existing export markets also showed a decline.
- The growth of existing export products to new export markets was moderate, however, no growth from new products in the extensive margin.
- A relative large share of product-market relationships became extinct since 2002

Implications:

Both local and international market incentives are crucial for successful diversification ventures. The outcomes of this objective reveal that market-driven diversification within South Africa's agro-complex can potentially be achieved along three channels of growth,



namely: import-substitution of large imports, substitution of large re-exports by local production, market diversification of existing products and the production of new export products.

iv. Develop a methodological framework for identifying diversification pathways in the agricultural product space:

- The product space concept was deemed the most appropriate method to identify diversification opportunities based on a country's current productive capabilities.
- The empirical framework of positioning a country in the agricultural product space should be based on the *Revealed Trade Advantage* (RTA) index as it simultaneously accounts for export and import specialisation and is thus a better reflection of local production.
- The *Proximity* measure in the agricultural product space should be based on the *Revealed Comparative Advantage* (RCA) index that is larger than one in three years of the five year period between 2007 and 2011 in order to absorb fluctuations in agricultural production.
- The identification of South Africa's diversification opportunities in the agricultural product space is founded on the measure of *Distance*.
- The *Product Complexity Index* (PCI) was deemed to be the most adequate indicator to measure the product- and sector level of complexity.
- Identification of opportunities for structural transformation is based on the *Product Complexity Index* (PCI) which is subsequently used in the calculation of the *Opportunity value* which identifies pathways for upgrading a country's productive structure.
- The measure of *Opportunity outlook* was developed to identify the long-term prospects for structural transformation from each diversification opportunity.
- The Decision Support Model (DSM) for identifying realistic export opportunities was deemed the most appropriate model to identify prospects for market diversification and new export products.
- The measure of *Substitution opportunity value* was developed to identify diversification opportunities in the product space with the highest potential for substituting re-exports with local production.



- The measure of *Export opportunity value* was developed to identify diversification opportunities in the product space with the highest potential for exports.
- The measure of *Import-substitution opportunity value* was developed to identify diversification opportunities in the product space with the highest potential for import-substitution.
- A *Labour intensity index* was constructed at the most disaggregated level of the agro-complex.
- The measure of *Employment opportunity value* was developed to identify diversification opportunities in the product space with the highest potential for employment creation.
- The measure of *Human capital opportunity value* was developed to identify diversification opportunities in the product space with the highest level of human capital intensity.

Implications:

A methodological framework was developed, that for the first time studies development in the agro-complex from the actual products produced. Furthermore, linking the product space concept with market incentives and employment is an extension of previous applications.

v. Construct and visualise the agricultural product space:

- A proximity matrix of 1 456 by 1 456 products was developed as basis for the agricultural product space
- 1 392 of the products (96 per cent) do have a connection with at least one other product.
- A relative low-degree of relatedness in the agro complex as 97 per cent of the proximity values are smaller than 0.5.
- The product-to-product relatedness is revealed with a threshold for the proximity value of 0.55 or higher.
- Six-hundred-eighty-four products were excluded since they had no revealed relatedness with other products in the agro-complex. This has left the basis of the agricultural product space to 772 products and 1 872 connections



- The agricultural product space was visualised (using the NodeXL software package for MS Excel), which has a core-periphery lay out and where each node represents a product and the strength of each edge represents the proximity between products.

Implications:

The agricultural product space provides a good reflection of the level of relatedness and clustering within the agro-complex and provides a wide variety of potential diversification pathways. Although a number of products with little prospects for diversification were excluded, the remaining products represent a significant proportion of global trade.

vi. Analyse the structure of the agricultural product space and the linkages between the different clusters of the agro-complex:

- Visual inspection of the agricultural product space clearly shows a core-periphery structure with denser parts in the centre and a sparser periphery.
- The denser parts of the network mainly comprise of textiles, natural fibres, wood, meat and agricultural machinery.
- The agricultural product space consists of 76 individual network communities; hence, it is not a single network.
- The individual network communities consist of one large single component and a significant number of smaller components, most of which comprise a single product grouping.
- Due to the exclusion of products with a limited degree of relatedness, the agricultural product space consists of 87 primary agricultural products, 245 agro-processing of food products, 285 agro-processing of non-food products, 110 forestry products and 45 agricultural input products.
- The number of linkages between products is the highest within the agro-processing of non-food cluster, followed by the agro-processing of food cluster. The agricultural inputs cluster shows the lowest degree of relatedness.
- The degree of relatedness between products within each cluster (i.e. horizontal linkages) is the highest in the agro-processing of non-food followed by primary agriculture and agro-processing of food clusters.



- Intra-cluster linkages of products between products from different clusters (i.e. vertical linkages) are the highest between agricultural inputs and agro-processing of food clusters and between the primary agriculture and agro-processing of food clusters.
- The strength of the intra-cluster linkages as measured by *Proximity* are mostly moderate although some very strong linkages exist between the agro-processing of non-food and primary agriculture clusters as well as between the forestry cluster and agro-processing of non-food cluster

Implications:

The outcomes presented under this objective provide some interesting stylised facts of the agricultural product space in a global context. Hence, the position of a country in the network will indicate more detailed perspectives for transformation. The relative low interconnectedness of the network implies a relative low level of relatedness within the agro-complex. This heterogeneity is not surprising due to the large variety of products within the agro-complex; each embedding its unique set of capabilities. However, it does limit the amount of diversification pathways in the network. Nevertheless, at cluster level some good potential for horizontal diversification was revealed. Furthermore, a significant number of network communities with a high degree of relatedness were also identified.

Vertical linkages in terms of input-output relationships have great potential for increasing local value adding; an important directive in economic development. Hence, the remarkable large number of intra-cluster linkages in the agricultural product space is a conducive condition.

vii. Determine and analyse South Africa's position in the agricultural product space:

- South Africa is exporting 92 per cent of the 1 456 products within the agro-complex and for 12 per cent of the products it has developed core competencies (i.e. high specialisation) and in a further 21 per cent of the products it has a relative low level of specialisation.



- Of South Africa's 172 core competencies in the agro-complex, 70 are located in the agricultural product space as the latter have a relative strong level of product-to-product relatedness. These comprise nine per cent of all products in the product space.
- Of South Africa's 307 products with a relative low level of specialisation, 156 are located in the agricultural product space. These comprise 20 per cent of the products in the agricultural product space.
- Combined, the core competencies and the products with a relative low specialisation comprise South Africa's total productive structure in the agricultural product space.
- The primary agriculture cluster embeds the highest relative presence of core competencies (25 per cent of all products within its cluster), followed by agro-processing of food (10 per cent) and agricultural inputs (7 per cent).
- The presence of South Africa's core competencies in the agricultural product space is dominated by agro-processing of food (25 products), followed by primary agriculture (22 products), agro-processing of non-food (13 products), forestry (7 products) and agricultural inputs (3 products).
- The largest proportion of products that are not locally produced by South Africa are within the agro-processing of non-food and agricultural inputs clusters (87 per cent) followed by the forestry cluster (76 per cent).
- South Africa's intra-cluster relationships (i.e. vertical linkages) are relatively few compared to the number of these relationships in the entire agricultural product space.
- The highest number of intra-cluster relationships of core competencies are found in the agro-processing of food cluster (50 per cent of its linkages) followed by agro-processing of non-food (33 per cent) and primary agriculture (26 per cent)
- Most intra-cluster linkages exists between the core competencies in the primary agriculture and the agro-processing of food clusters
- About 44 per cent of the country's core competencies have two or more linkages in the agricultural product space.
- The average proximity for all links from the 70 core competencies is 0.61.
- South Africa's core competencies which have the highest degree of relatedness with other products in the agricultural product space include peaches, wine and plums.



- Some of South Africa's deciduous fruits are centrally located in the denser parts of the agricultural product space which is unusual for primary products.
- The products in which South Africa has the highest specialisation (e.g. chemical wood pulp, fine animal hair and preserved apricots) are located in the sparser parts of the network.
- A total of 60 diversification opportunities in the agricultural product space can be "reached" from South Africa's core competencies and an additional 147 products can be "reached" from the products in which it has a low level of specialisation.

Implications:

About half of South Africa's products with a high level of specialisation are positioned in the sparser periphery of the agricultural product space, which seems cumbersome for diversification as the number of diversification pathways is generally more limited in those areas. However, the starting point of diversification also has important implications for successful diversification. It is envisaged that diversification ventures stemming from the country's core competencies are more likely to succeed. Those specific embedded capabilities and knowledge are well-developed which makes the transfer to "new" and related products relatively easier. Cognisance should also be taken of the products in which South Africa currently has a low level of specialisation as they will, in the process of developing competencies, also open up new opportunities in the agricultural product space. However, they should be regarded as a stimulus for "second round" diversification after the diversification options of core competencies have been depleted.

It became evident that not all of South Africa's core competencies are located in the agricultural product space due to the fact that they don't show a sufficient degree of relatedness with other products in the agro-complex. The relative high presence of core competencies from primary agriculture and agro-processing of food implies less unexploited potential but a relative easier transfer of capabilities to new products. The opposite is the case for the other three clusters.

South Africa's current level of input-output relationships of its core competencies in the agricultural product space is relatively limited, compared to the total number of these



linkages identified in the entire network. However, this thus provides ample opportunities to expand these and spur local value adding.

As evident from the visualisation of South Africa's position in the agricultural product space, it was estimated that the location of the country's core competencies is predominantly in the less connected sparser parts of the network. However, there are a number of exceptions. Rich countries tend to be specialised in the denser parts of the product space. Hence, it is evident that South Africa has to reach some convergence in this relationship by diversifying to new products with a higher degree of centrality.

The overall number of identified diversification opportunities from both the core competencies (60) and the overall product structure seems sound as it amounts up to 217 products. For the country's core competencies an average diversification opportunity ratio of 0.60 per product was revealed. Furthermore, 83 per cent of the product space network that remains initially unexploited. Realising all diversification opportunities stemming from the overall productive would potentially leave 43 per cent of the agricultural product space unexplored.

viii. Determine South Africa's diversification pathways for structural transformation in the agricultural product space:

- Structural transformation is determined by upgrading to more complex products.
- South Africa ranks 37th globally in terms of its agricultural export diversity.
- A statistical significant positive, but weak, relationship exists between agricultural export diversity and economic development
- South Africa ranks 69th globally in terms of its agricultural complexity.
- A statistical significant positive and strong relationship between the level of agricultural complexity and economic development was found.
- Lowest levels of product complexity within primary agriculture and highest levels of complexity within agricultural inputs exist.



- Products included in the agricultural product space represent 69 per cent of total global trade in the agro-complex. The most globally traded in value terms are processed food products followed by forestry products.
- Seventy-seven per cent of all products in the agro-complex for which South Africa has developed core competencies are classified as niche products.
- The more complex products within especially the agro-processing of food and agricultural input clusters have a higher level of connectedness in the agricultural product space. The opposite is the case for agro-processing of non-food.
- Some products located in the sparser parts of the agricultural product space embed a relative high level of complexity (e.g. some paper, wood, and meat products).
- The most complex product groups in the agro-complex are: vegetable extracts, wood pulp, tractors and agricultural machinery, machinery for food processing, and fertilisers.
- The least complex product groups are: vegetable plaiting material, natural rubber, tobacco products, cacao products, and vegetable fibres.
- South Africa's average level of complexity in all of the five clusters is higher for its imports than for its exports. This difference is the smallest for the primary agricultural cluster and the highest for the agricultural inputs cluster.
- South Africa's level of complexity of its core competencies is generally lower than the complexity of the products in which it has a lower level of specialisation. However, almost all of the 70 core competencies still have an above average level of product complexity in the agro-complex.
- All clusters reveal a gap between South Africa's complexity level of its production and the average level of complexity within each cluster. This gap is the smallest in the agro-processing of food cluster and the largest in the agro-processing of non-food cluster.
- In the forestry and agro-processing of food and non-food clusters, South Africa has developed some core competencies around products with relative high levels of product complexity.
- The majority of South Africa's core competencies with high levels of product complexity are included in the agricultural product space.



- Based on its current overall productive structure in the agricultural product space, South Africa's most viable diversification opportunities for structural transformation (upgrading) exists within the forestry (32) and agro-processing of food (86) clusters.
- The distance between South Africa's current production and the more complex products in the agricultural products space is not a limiting factor for structural transformation as the location of these upgrading opportunities is dispersed.
- Based on the upgrading opportunities from South Africa's core competencies, most products with a positive strategic value (i.e. a higher than the cluster's average product complexity) are within the agricultural inputs cluster followed by agro-processing of food as well as forestry.
- Most intra-cluster relationships (i.e. vertical linkages) between South Africa's core competencies and its diversification opportunities exists between the primary agriculture and agro-processing of food clusters as well as between the agricultural inputs and primary agriculture clusters.
- There are nine independent opportunity clusters with a minimum of ten products identified for South Africa in the agro-complex, and which include 67 per cent of all diversification opportunities.
- South Africa's potential for long-term structural transformation from "second-round" diversification in the agro-complex is the highest within the agro-processing of food cluster followed by the agricultural inputs cluster.
- The products with a long-term strategic value for structural transformation include: women's jackets of cotton, machinery for soil preparation, rape/colza seed, cotton t-shirts, and non-chemically obtained paper and paperboard.
- Of all diversification opportunities 45 per cent have no potential for long-term structural transformation and are thus so-called "death ends". About 13 per cent have a negative potential for long-term structural transformation and are so-called "downhill avenues".
- The most viable diversification upgrading opportunities include amongst others: chemical wood, pulp, mixtures of ammonium nitrate, dying extracts, prepared gherkins, meat of duck/geese/fowls, kraft paper, and coalfish. A complete overview and ranking



of South Africa's upgrading opportunities in the agro-complex is provided in Data Supplement IV.

Implications:

It was shown that diversity in the agro-complex alone will not lead to economic development per se but that what you produce is much more important for growth as was revealed by the analysis on the *Agricultural Complexity Index* of 116 countries. This notion is thus not only applicable to the wider economy but also to the agro-complex specifically. Hence, a country's set of underlying productive capabilities in the agro complex such as knowledge, institutions, technology human, capital, value chains matter significantly for economic development.

South Africa's current global position implies that the country can expect some convergence between its levels of economic development and agricultural complexity by diversifying to "nearby" products with a relative high level of complexity. However, a further increase in its levels of complexity, and subsequent economic development, will only occur by making relative large "jumps" in the agricultural product space.

South Africa has dominance in core competencies in primary agriculture. However, the levels of product complexity within this cluster are generally low. On the opposite, its core competencies in agricultural inputs are few; however, the levels of complexity within this cluster are very high. Hence, its current focus is not favourable for significant short-term progress in structural transformation.

However, in the agro-processing of food and agricultural inputs clusters, the levels of connectedness are relatively high. This makes diversification for structural transformation (i.e. upgrading) tentatively easier in these specific clusters. Furthermore, quite a significant number of complex products are located in the sparser parts of the agricultural product space, in which South Africa also has a relative good presence. This pattern deviates somewhat from what occurs in the economy wide product space in which the more complex products are almost all located in the denser cores.



The product complexity index revealed that the highest levels of complexity were calculated for agricultural machinery and fertilisers. On the other hand, the lowest product complexity was calculated for tropical agricultural products. South Africa's presence in all these product groupings is marginal and more concentrated in the product groupings with medium complexity levels.

It is worrisome that South Africa has a negative trade balance with regards to product complexity in the agro-complex. This implies that the country's imports products with higher complexity than what it exports. The low levels of complexity of South Africa's exports can be attributed to low levels of complexity of its core competencies as was also reflected by the relative low *Agricultural Complexity Index*. This notion underpins the fact that the country's comparative advantages are focused in areas with less complexity compared to its trading partners. Breaking out of this "complexity trap" requires the transformation to a productive structure which embeds a higher variety of unique capabilities. Furthermore, some cases of South Africa's core competencies with a significant high level of product complexity can be best-practice examples for the upgrading of the productive capabilities in other ventures. These may include: chenille fabrics of cotton, berries, cereal flakes, preserved apricots, mixtures of nitrate, bovine leather, non-chemically obtained paper and paperboard.

A significant proportion of the products in the forestry and agricultural inputs clusters have a low level of revealed specialisation combined with a high level of complexity. The level of complexity in these specific clusters will increase if South Africa focuses on developing the competencies underpinning these specific products. Furthermore, diversifying for structural transformation in the agro-complex cannot be derived from targeting only one single cluster but requires an inclusive product-level approach. It should be guided by the strategic value of a product in terms of its potential contribution to upgrading. Moreover, any concerted effort of targeting a bundle of products should rather be based on opportunity clusters than on the five categorised product clusters of the agro-complex.

A number of intra-cluster relationships were also identified between South Africa's current production and diversification opportunities. Thus diversifying for structural transformation



can also build stronger input-output relations in the agro-complex which is favourable for local beneficiation of raw products or the development of agricultural production inputs. Structural transformation is not a short-term process, but a long and slow process of changing a country's productive structure and underlying capabilities over time. As a country diversifies, new opportunities in the agricultural product space will open up. The extent to which these "second round" opportunities will become available also depend on the current choices of diversification pathways. It was shown that 42 per cent of the current diversification opportunities have a potential for long-term structural transformation in that they open up network linkages to more high complex products.

ix. Determine South Africa's market-driven diversification pathways in the agricultural product space:

- Products with a relative large global demand are scattered over the denser and sparser parts of the agricultural product space
- There is no relationship between product complexity and its global demand
- Apart from the primary agricultural cluster, most of South Africa's export potential in the agro-complex is concentrated in "new" products and not from its existing products.
- Most realistic export opportunities exist in the agro-processing of non-food cluster followed by agro-processing of food.
- Most realistic export opportunities for the agro-complex are prevalent in the EU 15, followed by Central and Eastern Europe and the Middle East.
- South Africa's overall variety of traded products in the agro-complex is high; the variety of exports is slightly lower than the variety of imports.
- The products that comprise South Africa's core competencies in primary agriculture comprise the largest share in the world trade within the agro-complex. The core competencies in the other clusters have a relative low market share in the world trade within the agro-complex.
- South Africa's core competencies in the agro-processing of food, non-food and the agricultural inputs cluster only have shares of 67, 59 and 38 per cent in their total clusters exports respectively.
- South Africa has a significant share of import specialisation in agro-processing of food.



- In the agricultural inputs and forestry clusters, the variety and value of re-exported products is significantly higher than in the other clusters. The value of re-exports is the lowest in the primary agriculture cluster and the variety of re-exports is the lowest in the agro-processing of food cluster.
- Only twenty-two of the re-exported products are connected to the country's core competencies, which include: grape juice, bread/pastry/cakes, poultry-keeping machinery, meat of sheep, saffron, and frozen turkey.
- Most of South Africa's top 20 opportunities for "new" export product are located in the agro-processing of food cluster.
- The top "new" export opportunities include products such as: soya beans, orange juice, prepared fruit and nuts, sunflower seeds, fresh cherries and preserved salmon.
- Most of South Africa's potential export value can be derived from new export products within the primary agriculture cluster and the least from the agricultural inputs cluster.
- Table Data Supplement VII provides a full overview and ranking of South Africa's new export opportunities.
- Number of large imports per cluster: 17 in primary agriculture, 74 in agro-processing of food, 69 in agro-processing of non-food, 44 in forestry and 19 in agricultural inputs.
- Only six products are identified as competitive import-substitution opportunities, which include: chemical wood pulp; soda/sulphate, other than dissolving grades; mixtures of ammonium nitrate; grape juices, unfermented; bread, pastry, cakes and biscuits; cuts and edible offal of turkey; and meat of sheep, frozen, bone-in.
- South Africa's core competencies in the agro-complex can potentially be exported to 12 additional markets on average.
- Total potential export value from market diversification of South Africa's core competencies could increase current export value by 11 times.
- The top opportunities of market diversification of existing products include: cane sugar, frozen fish fillets, berries, maize, soups, peaches and grapes.
- Data Supplement VIII provides a complete overview and ranking of the market diversification opportunities.



Implications:

South Africa's core competencies have a relative low market share in the world market. This is due to the fact that the variety of core competencies in most clusters is relatively low. Furthermore, most of the country's core competencies are niche products and not bulk commodities or manufacturers (e.g. wheat, palm oil, coffee, rice, tractors, and textiles); the latter comprise a relative large share of global trade in the agro-complex. As concluded in chapter three the orientation of South Africa's agro-complex towards growing global product markets is relatively weak.

South Africa's core competencies in four of the five clusters have a share of less than 80 per cent in their cluster's exports. This implies that a proportion of exports is not locally produced and thus consists of re-exports. This is especially the case in the agricultural inputs and the forestry clusters. Combined for all clusters, re-exports comprise 36 per cent of the total exports from the agro-complex. Apart from distribution activities, little local value adding is taking place for these products. Hence, the potential of competitively producing some of these products locally was investigated in this chapter, but revealed that the scope was limited. This was attributed to the fact that most of the re-exports are not connected to South Africa's current production. Furthermore, most of the few identified opportunities hold little strategic value for South Africa in the sense that their export values are lower than their cluster's median.

The import specialisation within the agro-processing of food cluster is relatively high which intuitively implies a large potential for import-substitution ventures. However, further analysis of competitively substituting some of the large imports in the agro-complex revealed little scope for this potential growth channel. Most of South Africa's large imports are not connected to its current productive structure, which would make any substitution undertaking uncompetitive and thus unsustainable. This situation has occurred in many developing countries in the past.

However, two of the growth channels that did show favourable prospects were market diversification of existing exports and diversifying to new export products. The former implied a significant growth potential in total exports especially from the primary agriculture



cluster. A similar pattern was evident for potential new exports products which showed a favourable scope in especially the primary agriculture cluster.

x. Determine South Africa's diversification pathways for employment creation in the agricultural product space:

- Sixty-six per cent of the total employment within the agro-complex is contributed by the primary agricultural cluster.
- The primary agricultural cluster has both the highest and the largest spread in labour intensity.
- The agricultural inputs cluster has the lowest labour intensity followed by agro-processing of food.
- The average labour intensity of South Africa's imports within the primary agriculture, agro-processing of non-food, forestry and agricultural inputs clusters are higher than of these cluster's respective local production.
- There is a gap between South Africa's average labour intensity in each cluster and the average labour intensity of the entire agricultural product space.
- South Africa has a higher level of specialisation in the more labour intensive products of the agro-complex.
- The more labour intensive products tend to be located in the sparser parts of the product space.
- The primary agriculture cluster has the highest potential for employment creation within South Africa's agro-complex although the number of opportunities is relatively few.
- The diversification opportunities with the highest potential for employment creation include: saffron, strawberries, walnuts, sunflower seeds and natural cork.
- Thirty per cent of the products in the agricultural product space can be classified as high value. The agro-processing of non-food cluster encompassed the most high-value products which has implication for off-setting its low labour intensity.
- Only five of the top ten diversification opportunities have a positive strategic value in that their labour intensity is higher than South Africa's average for a specific cluster.



- Data Supplement IX provides a complete overview and ranking of the diversification opportunities with the highest potential for employment creation.
- The highest average human capital intensity can be found in the agricultural input cluster followed by the forestry cluster.
- The lowest average level of human capital can be found in the agro-processing of non-food cluster followed by the primary agriculture cluster. However, the products with highest human capital intensity can be found in the agro-processing of food cluster which thus implies that this cluster has the largest variety in human capital.
- Human capital intensity of South Africa's imports in the agro-processing of food, forestry and agricultural inputs clusters are higher than for these cluster's respective local production.
- A relative significant proportion of the products in which South Africa is specialised show a relative large gap with the country's human capital endowment.
- A relative high and statistically significant relationship between human capital intensity and complexity for the products in the agro-complex.
- The products in the agro-complex with higher human capital intensities are less centrally located and thus less connected in the agricultural product space.
- The largest scope for developing human capital in South Africa's agro-complex can be derived from diversification within the primary agriculture cluster followed by the agro-processing of food cluster.
- The diversification opportunities in the primary agriculture cluster hold equal prospects for increasing both employment and the human capital development in the agro-complex.
- Most of the top opportunities for human capital development are located within the agro-processing of food cluster.
- The agro-processing of non-food cluster has the largest proportion (56 per cent) of diversification opportunities with human capital intensities that are on par with South Africa's current human capital endowment.
- Data Supplement X provides a complete overview and ranking of the diversification opportunities with the highest potential for human capital development.



Implications:

The labour intensity of South Africa's exports in the agro-complex is lower than the labour intensity its imports. Hence, the country has a negative trade balance in terms of labour intensity which is very cumbersome against the background of the country's high unemployment rates.

For most clusters the average labour intensity of South Africa's productive structure is lower than that of the other products in the agricultural product space. This generally implies favourable prospects for employment creation from diversification ventures within the network.

It was determined that South Africa's has mainly build core competencies in those products with a relative lower level of labour intensity. Against the background of employment creation within the agro-complex, competencies should also be developed in those products with a relative high labour intensity.

Most opportunities for employment creation from diversification exist within the primary agriculture and forestry clusters although the total number of opportunities is relatively few. Furthermore, the agro-processing of food cluster has the highest number of diversification opportunities but the potential for employment creation is relatively low. However, it was argued that a relative low labour intensity can be partly offset by a high product unit value as this reflects the ability to create more output. This offset could potentially be the most favourable within the agro-processing of non-food and the agricultural inputs clusters due to their relative high product values.

The top ranked diversification opportunities for employment creation are predominantly in the primary agriculture cluster. Apart from the ranking based on the *Employment opportunity value*, the strategic value with regards to the products' positive contribution to the country's level of labour intensity is of significant importance.

In terms of the quality dimension of employment which is reflected by the human capital intensity, the clusters do not differ much. However, there exists a large variance of human capital intensity in each cluster. This implies that each cluster includes products with a



relative high human capital intensity. Similar to the pattern of labour intensity, South Africa's also has a negative trade balance with regards to human capital intensity.

Sixty-eight per cent of the products in which South Africa developed a core competency have a higher intensity of human capital than the country's endowment. These predominantly consist of processed food and forestry products. This condition puts significant strain on the sustainability of production and exports of these products. Therefore, diversifying to products which require a higher level of human capital is not realistic without significant improvements in South Africa's human capital development in agriculture

There exists a strong statistical significant relationship between human capital intensity and the level of product complexity in the agro-complex. This implies that structural transformation to more complex products is likely to increase the demand for higher skilled labour. Furthermore, pressure from local labour policies will likely result in increased mechanisation which also requires skilled labour. This again puts strain on the country's current human capital endowment.

The diversification opportunities with a high level of human capital intensity form a push-incentive for targeted skills and knowledge development in specific parts of the agro-complex. However, the level of human capital intensity of the diversification opportunities in the agro-processing of non-food cluster is more on par with South Africa's human capital endowment. Hence, diversifying within this specific cluster will put less strain on human capital and ensure the sustainability of diversification ventures in the short-term.

Implications from all three strategic values for diversification:

The decision of which of the three strategic values (i.e. structural transformation, market-driven diversification, and employment-driven diversification) is chosen as the main driver for diversification depends on the actor in the economy. The public sector would rather focus on structural transformation through upgrading as well as employment creation as where the private sector would see market demand as the main driver for diversification.



However, diversification pathways which score favourable on all three strategic values would be the ultimate.

Analysis showed that there exists a statistical significant but negative relationship between product complexity and export potential. Furthermore, a statistical significant and negative relationship between product complexity and labour intensity was also revealed. Finally, it was shown that there exists no statistical significant relationship between export potential and labour intensity. Overall, these results thus imply that it will be difficult to identify diversification opportunities in the agro complex that simultaneously embed favourable prospects for all three strategic values.

The ranking based on all three strategic values, based on an equally weighted standardised score, showed that these includes amongst others: wood sawn lengthwise, walnuts, almonds, saffron, chemical wood pulp, fireboard of wood, coniferous wood in chips, and wooden furniture. It became evident that most of the top ranked diversification opportunities fall within the forestry cluster. A complete overview of the consolidated ranking can be found in Data Supplement XI.

7.4.2 Contributions of the study

This section will briefly highlight the specific contributions of the study in terms of scientific approach and the creation of new knowledge.

- A holistic approach was followed in terms of a very broad agricultural sector scope including agricultural inputs, secondary agriculture, primary agriculture, and forestry which comprises the agro-complex, without neglecting product-level dynamics.
- An in-depth analysis of South Africa's trade performance within the agro-complex along the lines of the intensive margin, extensive margin, quality margin and sustainability margin provided valuable new insights and substantial background.
- This study for the first time investigated development within the agro-complex from a product perspective by applying the product space and related concepts.



- Refinements in the product space methodology were made in terms of the determination of a country's productive structure and improving the time-robustness of the network.
- Potential growth in the agro-complex was investigated along three strategic dimensions within the product space framework: structural transformation, market-driven diversification and employment driven diversification.
- A variety of new measures were developed to identify the most viable diversification pathways in the product space in terms of: long-term potential for structural transformation, import substitution, substitution of re-exports, human capital development, new exports, and employment creation.
- Detailed horizontal- and vertical product linkages in the agro-complex were determined.

7.5 RECOMMENDATIONS

The analysis and outcomes of this study have predominant implications at macro- and policy level. This section firstly provides a framework for the development of a diversification strategy based that is based the outcomes of this study. Secondly, supporting the diversification strategy, some policy recommendations are given for each of the three identified strategic values (i.e. structural transformation, market demand, employment). Finally, some guidance for future research initiatives is provided.

7.5.1 *Conceptual diversification strategy for the agro-complex*

In this study it is argued by this study that the private sector should take the lead in exploiting diversification opportunities within the agro-complex. Economic growth and development will predominantly have to come from simply selling and producing more products. Although crucial for socio-economic development, structural transformation and employment creation are secondary imperatives that will not take place without the former. Given, the above, the main question that arises from the outcomes of this study is why South African firms have not already exploited those diversification opportunities with



favourable demand conditions. Section 2.5.4 already provided some insights into the patterns of firm-level diversification. It was confirmed that firms tend to diversify to related products but that diminishing first-mover advantages and market failures (i.e. uncertainties) are the main constraints. Hence, business risks for South African firms have been simply too high to justify the pursuance of these existing diversification opportunities. Hence, a concerted effort between public- and private sector is needed to overcome these risks and enable “jumps” to the identified new products within the agricultural product space.

This concerted effort needs to be captured by a diversification strategy which can be implemented at sub-sector level of the agro-complex. Hence, a practical blueprint for a diversification strategy is provided here which aims to capitalise on the opportunities identified in this study. This is a conceptual structure which requires customisation for each individual sub-sector. The steps of the strategy are presented in a sequential order:

- Establish a principal project-coordinating body for each of the five clusters (i.e. primary agriculture, agro-processing of food, agro-processing of non-food, forestry and agricultural inputs) in the agro-complex comprising of representatives of industry organisations (e.g. AgriSA, Forestry SA), government departments (e.g. DAFF, DTI), parastatals (e.g. National Agricultural Marketing Council, Industrial Development Cooperation), universities and / or a local / foreign investment institution (e.g. development bank).
- Identify priority products based on the ranking of all three strategic values per sub-sector within each cluster (see Data Supplement XI).
- Establish whether the priority products have vertical linkages, for value adding opportunities, is part of an opportunity cluster, for consolidated diversification, or has long-term potential for structural transformation.
- Select the most important stakeholders in the respective sub-sector and establish a project-team among them to develop the diversification strategy. These can be firms, industry organisation (e.g. Hortgro), and research institutions (e.g. Agricultural Research Council).
- Identify the origin of the diversification opportunity (i.e. the product already produced by South Africa) and conduct an analysis of the similarities and gaps of the productive



capabilities of these products. This should be done in terms of, but not limited to: skills, regulations, capital assets, knowledge, property rights, regulatory requirements, institutions, natural resources, technology, supply chains, and infrastructure.

- Based on the gap analysis it can be determined which productive capabilities and knowledge either needs to be acquired or locally developed.
- Select the capability gaps in the local and regional government and administration sphere and determine how these should be addressed by the public sector.
- Select the capability gaps in the knowledge and technology sphere and determine how these should be mutually addressed by the public sector, private sector, educational institutions and potential foreign stakeholders.
- An investment programme should be developed to determine the financial requirements of capitalising on the selected diversification opportunities in each sub-sector. This programme should explore opportunities for foreign investment sources as these may conjoin crucial technology and knowledge spill-overs.
- A marketing programme should be developed in order to capitalise the identified local and international market potential (e.g. export promotion strategy, trade facilitation, distribution network)

7.5.2 Policy recommendations

Underpinning the diversification strategy, a number of specific overhauling policy requirements need to be implemented by national government. These policies and programmes support the three strategic values (i.e. structural transformation, market demand and employment) and are presented here

- Structural transformation is the strategic value which forms an important directive for government in order to lift current levels of growth. As shown by this study, this can be achieved by diversifying the current product structure to more complex products. This process of upgrading is underpinned by the following policy recommendations and initiatives:
- Boost the effectiveness of current innovation and research programmes as well as the enhancement of collaboration between private sector and academic institutions



specifically on the development of South Africa's agro-complex. The current initiatives include: the Technology and Human Resources for Industry Programme (THRIP), Thuthaka Programme, the Technology Innovation Agency (TIA), the Product Process Development Scheme (PPD), and the Support Programme for Industrial Innovation (SPII).

- Increase the public R&D funding for investigating the expansion potential of primary agricultural production through increased productivity, intensification or scale by the.
- Increase public R&D funding for research on secondary agricultural activities.
- Cluster development of related core competencies comprising both horizontal- and vertical product linkages.
- Focus on the vertical linkages between primary and secondary agriculture in industrial policy.
- An efficient trade mark, patent and intellectual property registration processes.
- Apply tax breaks for investments in innovation and diversification within the agro-complex.
- Establishment of new trade agreements should focus on increased market access in specifically those markets which have the highest realistic export potential for South Africa's agro-complex (e.g. countries in the Middle-East and within the ASEAN community).

Diversification driven by local and international market demand is an important strategic value for especially the private sector. It was revealed by this study that this could be achieved by producing new export products and market diversification of existing products. However, an important constraint to diversification at firm-level is that the first-mover benefits of export diversification can be quickly imitated by other firms. Furthermore, uncertainties such as productivity, cost, quality, demand, price and market also play an important role in limiting diversification. A conducive policy environment that minimises the business risks is thus essential. Therefore, the following policy recommendations are made:

- Increasing barriers to entry, but avoiding monopolistic practices, this can be done by for instance: licensing, permits, appropriate product and process standards, patents, vertical integration, and research and development policies and programs by the



Department of Trade and Industry (DTI) and the Department of Agriculture, Forestry and Fisheries (DAFF).

- Applying temporary infant industry protection by the Department of Trade and Industry (DTI) until the production of “new” products is relatively matured.
- Improve trade facilitation within the agro-complex such as ensuring market access by the Department of Agriculture, Forestry and Fisheries (DAFF), improving the domestic distribution network by Transnet and the South African National Roads Agency (SANRAL), and improving time and efficiency of export procedures by Transnet.
- Coordination of effective export promotion and facilitation initiatives by the National Agricultural Marketing Council (NAMC) in conjunction with the relevant producer’s organisation.
- Form a designated division within Trade and Investment South Africa (TISA) as well as within provincial investment promotion agencies to attract and facilitate technology-driven foreign investment in specifically South Africa’s agro-complex.
- The effective dissemination of intelligence on diversification opportunities within the agro-complex by local universities, industry organisations and investment and export promotion agencies.
- Boost effectiveness of export development and assistance programmes, e.g. the National Exporter Development Programme (NEDP), the Export Marketing and Investment Assistance (EMIA) of the Department of Trade and Industry (DTI).
- Develop an incentive scheme for developing “new” production ventures within primary agriculture by the Department of Agriculture, Forestry and Fisheries (DAFF).
- Increase the awareness of the Manufacturing Competitiveness Enhancement Programme (MECP) of the Department of Trade and Industry (DTI) which also provides assistance to food processors and agricultural input manufacturers via production incentives, finance and loan facilities.
- Clear, directed, fact-based and realistic policy developed by government in an inclusive process;
- Investment programmes in diversification ventures by the Land Bank and the Industrial Development Corporation (IDC).



From a social perspective, the creation of more and better employment is the single most important strategic value for diversification in the agro-complex. However, current stringent labour policies and the relative low level of human capital endowment are not conducive in this regard. Therefore the following policy recommendations are made:

- The Department of Labour in conjunction with the Department of Agriculture, Forestry and Fisheries (DAFF) should address the country's dismal labour market efficiency in terms of cooperation in labour-employer relations, hiring and firing practices, flexibility of wage determination and pay and productivity (WEF, 2013) which has a negative impact on especially the relative labour-intensive agro-complex.
- Development of the level of human capital within the agro-complex by private and public sector through increased investments in tertiary agricultural sciences and engineering education. Specifically focussed on those production activities which show the most potential for structural transformation and market demand. This will furthermore enhance the distributional effects of diversification as the level of human capital strongly relates to higher wages.

7.5.3 Future research initiatives and applications

The limitations of the study have left some areas open for further exploration. Furthermore, the outcomes also provide incentives for new research initiatives. These opportunities include:

- Developing diversification strategies for the identified products within entire agro-complex (see Section 7.4.1).
- Investigation of the impact of the complexity of South Africa's agro-complex on its future levels of growth.
- Analysing the potential for local value adding from the vertical linkages in the agricultural product space.
- Investigating the agricultural product space in a regional context to determine the potential for cross-border value chains.
- Conducting firm-level research on export successes and failures to inform future export diversification strategies.



- Investigating the relative high number of export extinctions in agro-complex and learn lessons for the sustaining of exports after the discovery phase.
- Providing a scientific-based identification of priority products for economic development initiatives.
- Providing a scientific basis for industrialisation and local value adding incentive programmes, e.g. the agro-processing initiative as laid out in the Industrial Policy Action Plan 2 (IPAP).
- Providing inputs for the appraisal of finance application to the Agro-industries Business Unit of the Industrial Development Corporation (IDC) or the Land Bank.
- Providing inputs to the National Export Strategy of the Department of Trade and Industry (DTI). One example where the product space framework was used as a basis was Malawi's national export strategy.
- Providing guidance for the Agricultural Trade Strategy of the Department of Agriculture, Forestry and Fisheries (DAFF).
- Investigating the alignment between the demand-driven diversification opportunities within the agro-complex and south Africa's trade policy.