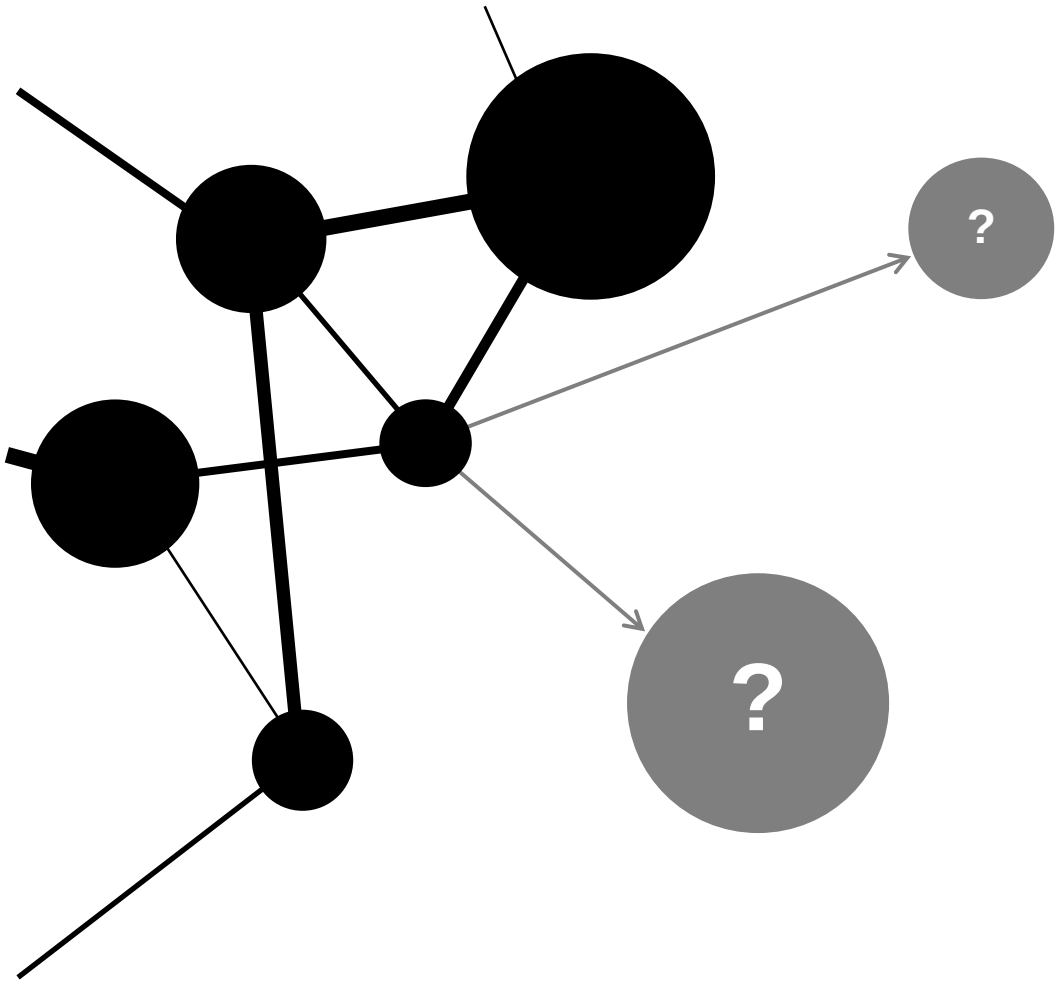
CHAPTER 6

PATHWAYS OF DIVERSIFICATION

Potential for structural transformation, market demand and employment creation in the agricultural product space



6.1 INTRODUCTION

The previous chapter provided the framework (i.e. the product space) that forms the basis for the analysis and results presented in this chapter. Chapter six identifies the product-level growth paths for South Africa's agro-complex in the agricultural product space, based on the three strategic values for diversification. These strategic values have been presented in the previous chapters (see, for instance, Sections 1.2, 3.10, and 4.6) and include structural transformation, market-driven diversification, and employment-driven diversification. The methodological framework for applying these strategic values within the product space framework was presented in Sections 4.3 to 4.5. These directives are all essential for South Africa's economic development and its future growth path. Hence, they should not be attained in isolation from each other, but rather in a consolidated effort.

Firstly, this chapter provides a brief analysis of the link between diversification and economic development. The subsequent three sections present South Africa's product-level potential for structural transformation, market-driven diversification and employment-driven diversification in the agro-complex. The final section of this chapter provides some consolidation of product-level results for these three strategic values.

6.2 DIVERSIFICATION

The degree of agricultural diversification reveals a great deal about a country's number of embedded capabilities. However, natural constraints may especially limit the number of capabilities a country has, or may develop, in the land-intensive sub-sectors of primary agriculture and forestry. These geographical constraints are less limiting for the more intensive production practices in primary agriculture and agro-processing. Nonetheless, enhancements in technology and knowledge have led to improved production practices, resulting in shifts in the geographical production frontier of some primary agricultural products.

Figure 6.1 below shows the agricultural diversity of 116 countries[34] in relation to their respective levels of economic development. The latter is measured by per capita GDP, based on purchasing-power-parity (PPP). Diversity reflects the number of products of the agro-complex that a country produces and is measured by an RCA index equal to or higher than 1 (see also equation 11 in Section 4.3.3). Although the RTA index provides a better reflection of local production, data limitations prohibit the calculation of this index for a large group of countries. Hence, the actual degree of agricultural diversity is likely to be smaller. Nevertheless, the graph provides a good indication of the relative diversity of South Africa's agricultural sector.

The figure shows that South Africa has a relatively well diversified agricultural sector in relation to its level of economic development. Furthermore, the country is located above the fit line. Globally, the country ranks 37th with regard to agricultural diversity and 67th in terms of economic development. Further analysis of the correlation between agricultural diversity and economic development reveals that, although this relationship is statistically significant and positive, it is relatively weak. This is underpinned by a Pearson's correlation coefficient of 0.20, which is significant at the 0.05 level. Taking cognisance of the above, diversifying is not an economic strategy in itself; it needs to be guided by socio-economic imperatives (i.e. strategic values) in order to spur economic development.

Diversity in the agro-complex alone will not lead to economic development per se. As discussed in Section 2.5.3, Imbs and Wacziarg (2003) found that most countries tend to diversify their economy (i.e. exports) up until a certain threshold of economic development, after which a process of specialisation follows. However, as revealed in Section 3.5.3 (see Table 3.5), South Africa's level of agricultural specialisation is on the decline. Although the broad level of its agricultural diversity from an export perspective may not seem so cumbersome at first sight, the previous chapter revealed that the overall degree of specialisation in agriculture is weak (see Section 5.3.1). Hence, its presence in the agricultural product space is relatively low and concentrated towards the sparser areas in the network.

[34] The initial dataset included 121 countries; however for 5 countries no data on per capita GDP was available.

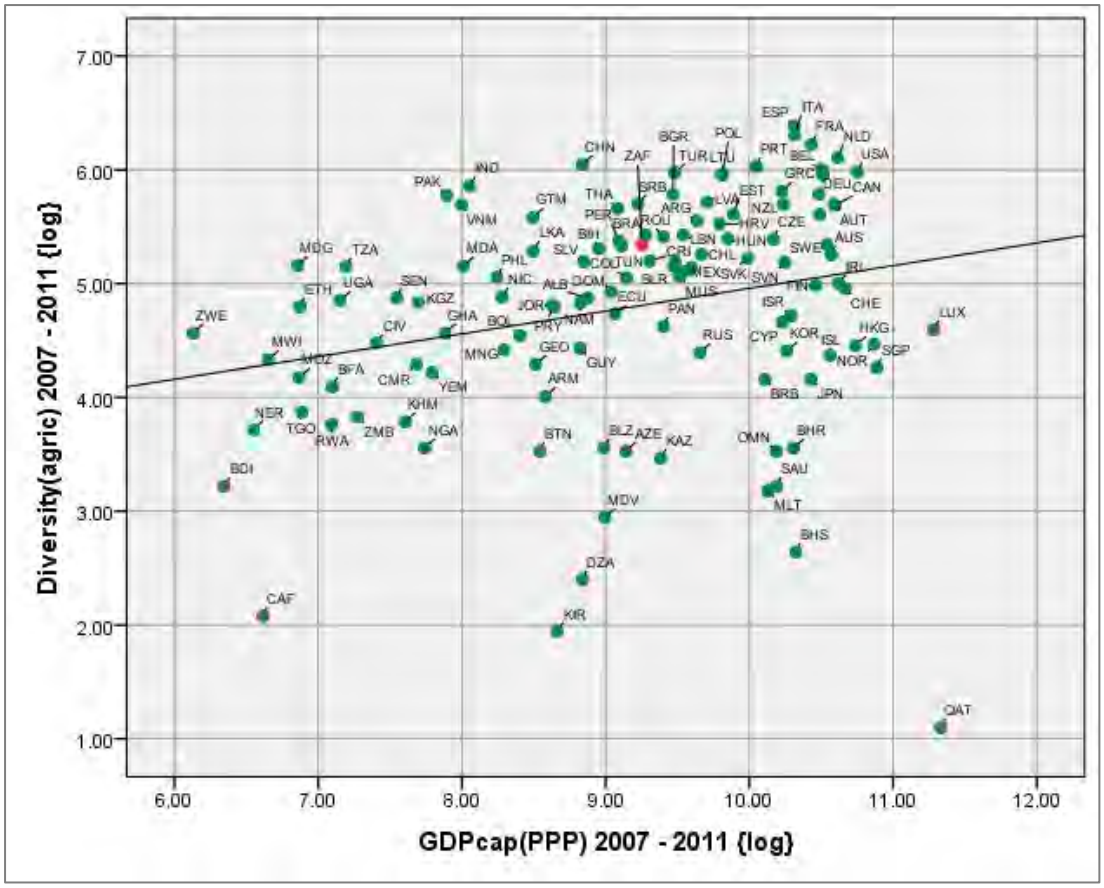


Figure 6.1: Agricultural diversity and economic development (2007 – 2011)
Source: Author's own calculations based on data from UN Comtrade and the IMF (2013)

6.3 STRUCTURAL TRANSFORMATION

6.3.1 Introduction

Guided by the empirical measurement of complexity (see Section 4.3.3), this section will explore the pathways of diversification in the agricultural product space, leading to the upgrading of South Africa's productive structure in the agro-complex. This thus implies a structural transformation of the country's economy which is beneficial for growth and development (see Section 2.5.3). Structural transformation was identified as one of the strategic values for diversification. The concept of complexity in this study implies the intensity of knowledge, technology, and quality of institutions associated with higher levels of productivity (Hausmann *et al*., 2011).

As discussed in Section 4.3.3, the level of complexity is measured by the Economic Complexity Index (*ECI*) and the Product Complexity Index (*PCI*), as developed by Hidalgo and Hausmann (2009). These indices are calculated on the basis of a product–country matrix for the period 2007 to 2011. This matrix has a dimension of 121 countries and 1 392 products[35] from the agro-complex. It contains information on the product–country combinations which reveal an RCA > 1 for at least three of the five years.

The first step in the calculation uses the method of reflections by iterating the equations for diversity and ubiquity (see Equations 11, 12, 13 and 14 in Section 4.3.3) until these indicators converge to their means (i.e. the condition in Equation 15 in Section 4.3.3 is satisfied). In the dataset of this study, the basis for the ECI was reached after 12 iterations (i.e. Kc_{12}) and the basis for the *PCI* was reached after 11 iterations (i.e. Kp_{11}). The second step in the calculation of the *ECI* and the *PCI* standardises the Kc_{12} and Kp_{11} indicators (see Equations 16 and 17) in order to obtain relative values for each country and product in the dataset. This results in an index with a mean of zero and a higher positive value of the PCI as well as the ECI thus implies a higher level of complexity.

6.3.2 The Agricultural Complexity Index

The *ECI* for the 121 countries was calculated solely on the basis of products from the agro-complex. Since it thus measures the level of agricultural complexity of countries, the index calculated for this study will accordingly be referred to hereinafter as the Agricultural Complexity Index (*ACI*). As discussed in Section 4.3.2, a strong relationship exists between the level of the ECI and the current level of economic development, as well as future economic growth of countries. Figure 6.2 explores whether a similar relationship exists between the ACI and the level of economic development, based on a dataset of 116 countries. The position of South Africa shows that its ACI is relatively low, even below the fit line. Hence, this performance is inferior to its position with regard to agricultural diversity (see Figure 6.1). The country ranks 69th globally on the basis of agricultural complexity, with an index of -0.134. Of the eight selected peer countries[36] (see Chapter three), only Thailand

[35] The initial dataset consists of 1 456 products classified at the six-digit level of the HS (see also Data Supplement I); however, 64 products which were not traded in the period from 2007 to 2011 were eliminated from the matrix.

[36] Argentina, Brazil, Chile, India, Thailand, Australia, USA, and France

has a weaker A*CI*. South Africa's ranking in the *ACI* is 14 positions lower than the country's ranking of 55th in the overall ECI, based on all economic sectors, as estimated by Hausmann *et al*. (2011).

Finland has the highest A*CI*, with a value of 1.589, implying that the country has the highest level of productive capabilities and knowledge with regard to the agro-complex. Its agro-complex is dominated by forestry, dairy and cereal production (Eurostat, 2013). The lowest index was recorded for Kiribati, with a value of -3.133. The agro-complex of this small island nation consists solely of marginal copra production and fisheries. Table A.2 in Annexure II provides a complete country ranking on the basis of the *ACI*.

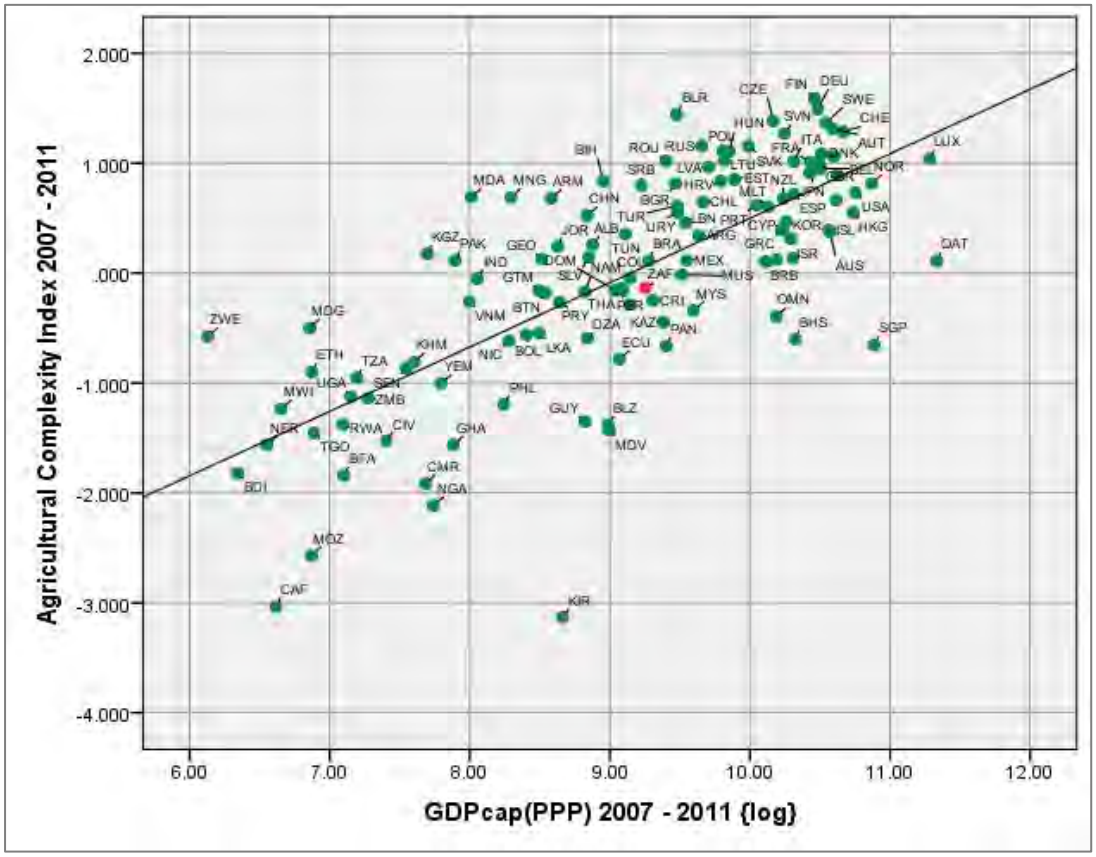


Figure 6.2: Agricultural complexity and economic development (2007 – 2011)
Source: Author's own calculations based on data from UN Comtrade and the IMF (2013)

South Africa's current performance indicates that the country can expect some convergence between its levels of economic development and agricultural complexity by diversifying to

"nearby" products with a relatively high level of complexity. However, a further increase in the *ACI,* and subsequent economic development, will only occur by making relatively large "jumps" for diversifying in the agricultural product space (see also next section).

Further analysis of the statistical correlation between agricultural complexity and economic development reveals a strong relationship. This is reflected by a Pearson's correlation coefficient of 0.73 which is significant at the 0.01 level. Hence, the argument by Hausmann *et al.* (2005) that what you produce matters more for growth (even in agriculture) than the variety of production is once more underpinned.

This section has investigated the overall level of complexity within the agro-complex, and the next section analyses the levels of complexity at cluster and product level.

6.3.3 Product complexity in the agro-complex

The ability of countries to diversify and to move to more complex products is crucial for structural transformation and is based on their initial location in the product space (Hausmann *et al*., 2011). Hence, this section will present some stylised facts on the complexity of products in the agro-complex, as measured by the Product Complexity Index (PCI). Firstly, the distribution of the values of the PCI in the agro-complex is analysed. Figure 6.3 below shows a separate histogram for the frequency and cumulative distribution of the PCI for each of the five agricultural clusters. All 1 456 products of the agro-complex are included in the respective histograms. The dashed line in each chart represents the mean value (i.e. zero) of the complexity index.

The figure shows a similar type of distribution across the complexity scale for the different clusters which is positively skewed and has a few outliers on the lower end of the scale. In all of the clusters of the agro-complex, most products have a *PCI* of between 1 and 2. Furthermore, the figure reveals some differences of the level of complexity of each cluster. The proportion of products with an above-average level of complexity for primary agriculture, agro-processing: food, agro-processing: non-food, forestry and agricultural

inputs are 75, 88, 91, 92 and 99 per cent, respectively. Thus, in general, primary agricultural products are the least complex and agricultural inputs are the most complex.

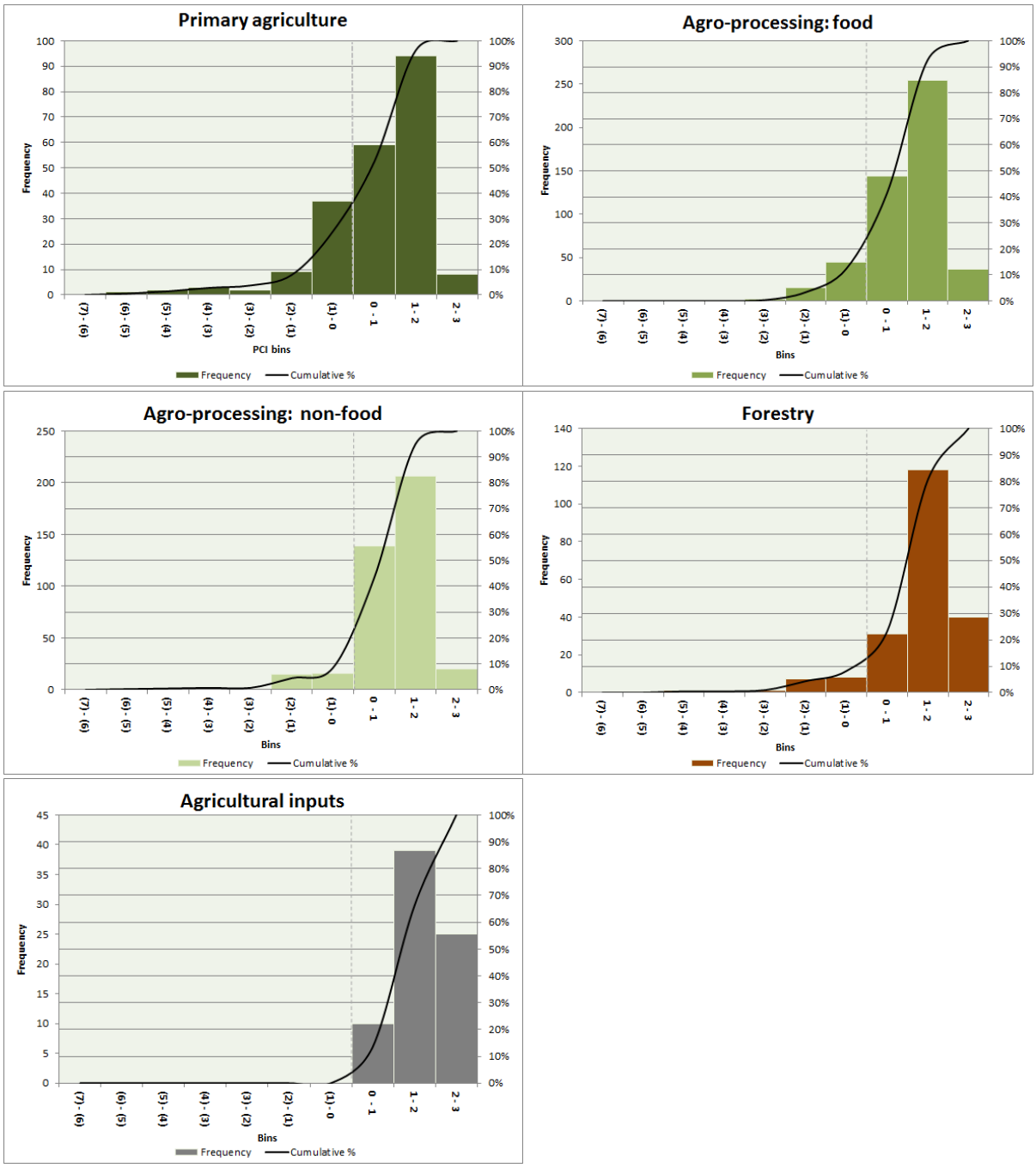


Figure 6.3: Overview of complexity distribution per agricultural cluster
Source: Author's own calculations (2013)

Figure 6.4 below elaborates on this concept by comparing the average complexity and the level of connectedness in the product space for each cluster. The former is measured by the

PCI and the latter is measured by *Centrality* (see Section 4.2.4). The product base for the figure is narrowed down to comprise only those 772 products included in the agricultural product space (see Chapter 5). Hence, products with a relatively insignificant level of relatedness to other products are excluded. Furthermore, the size of the bubbles in the figure represents each cluster's value share in global agricultural trade in the period 2009 to 2011.

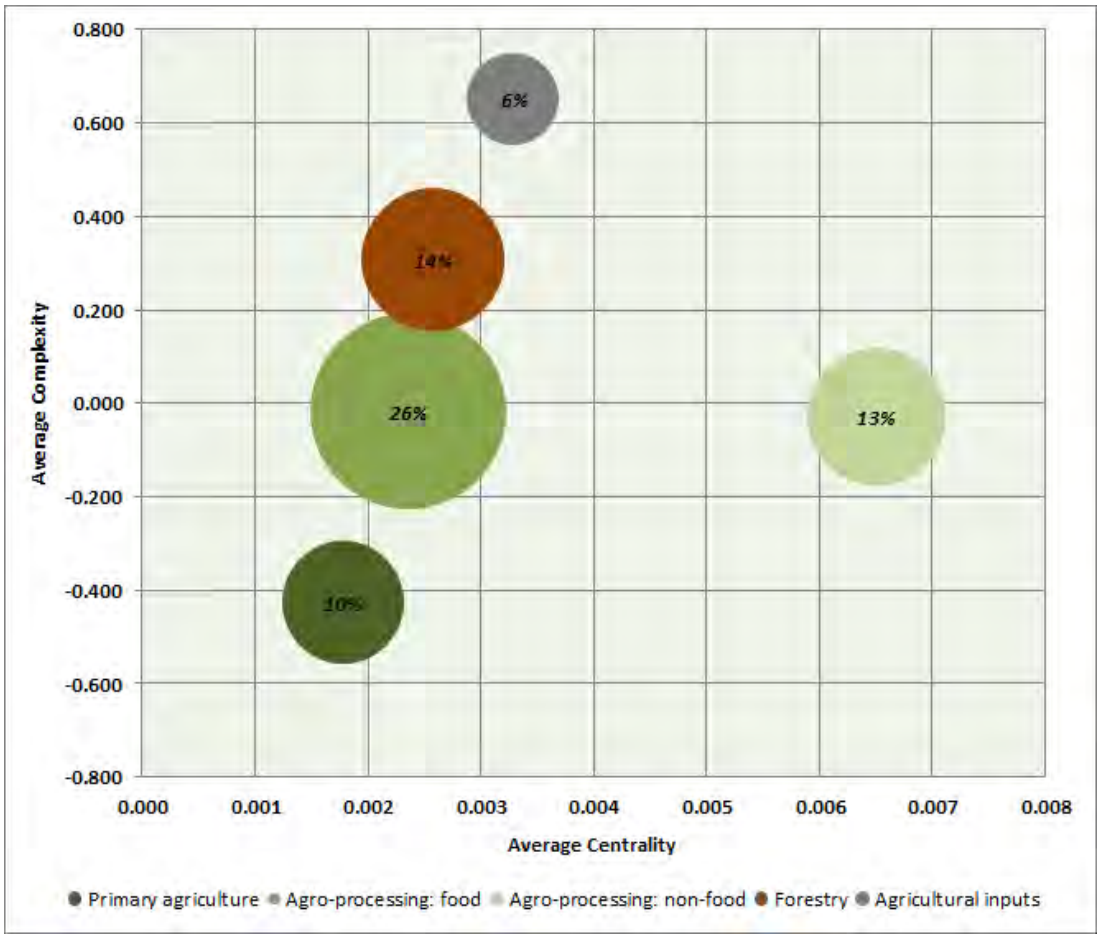


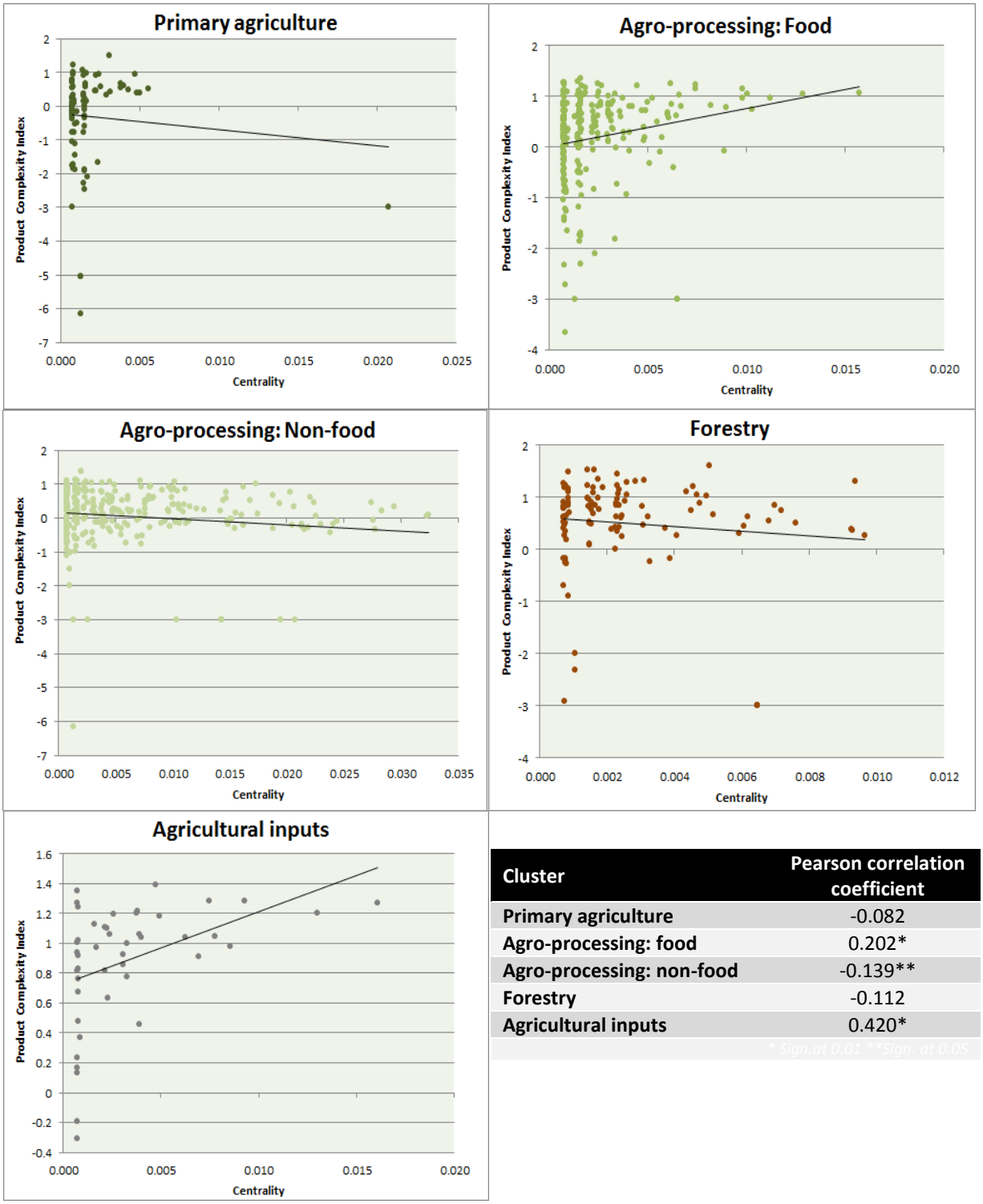
Figure 6.4: Complexity and connectedness of the five agricultural clusters
Source: Author's own calculations (2013)

Figure 6.4 further confirms that primary agricultural products are the least complex and also the least connected. Furthermore, agricultural inputs are the most complex, but not the most connected. That position is claimed by the agro-processing of non-food cluster, which has a level of complexity similar to the agro-processing of food cluster. The forestry cluster

has the second highest level of complexity and is slightly better connected than the agro-processing of food cluster.

Figure 6.4 reveals, furthermore, that the products included in the agricultural product space, being the products that have a significant level of relatedness with other products, make up 69 per cent of global agricultural trade. The most globally traded in value terms are the processed food products, followed by forestry products. Agricultural inputs and primary agriculture have to smallest proportion. To further investigate the relationship between trade and complexity, a correlation analysis was conducted. This analysis does not determine whether any causality exists between the subjects, but solely estimates if there is a statistically significant relationship between the level of trade and the level of complexity. The analysis reveals a Pearson correlation coefficient of -0.02, which was not found to be statistically significant. This implies that products in the agro-complex with a higher degree of complexity do not tend to be traded more globally than products with a lower level of complexity. This implies that diversifying to more complex products is nuanced, as international market incentives may not be always prevalent.

The degree and direction of the relationship between the levels of complexity and connectedness of the clusters is not evident from Figure 6.4. A positive relationship would be preferable for diversification as it is relatively easier to move towards new products in the denser, more connected, parts of the agricultural product space. Therefore, Figure 6.5 below depicts the detailed product–level relationship between the *PCI* and *Centrality* for each of the clusters in the agro-complex.



Cluster	Pearson correlation coefficient
Primary agriculture	-0.082
Agro-processing: food	0.202*
Agro-processing: non-food	-0.139**
Forestry	-0.112
Agricultural inputs	0.420*

** Sign.at 0.01 **Sign. at 0.05*

Figure 6.5: Product-level relationship between complexity and connectedness

Source: Author's own calculations (2013)

Apart from the graphical depiction, Figure 6.5 also indicates the statistical significance and magnitude of the relationship between product-level complexity and connectedness, as

reflected by the individual fit lines. The figure indicates that the more complex products within the clusters of agro-processing of food and agricultural inputs have significantly more connections in the agricultural product space. This makes diversification for structural transformation (i.e. upgrading) tentatively easier in these specific clusters. Owing to the statistically significant and negative correlation coefficient, the opposite is the case for products in the agro-processing of non-food cluster. Diversification to more complex products in primary agriculture and forestry clusters is not dependent on the degree of connectedness as no statistically significant relationship is revealed. However, the country-specific implications for structural transformation also depend on its current location in the product space.

The distribution of the level of complexity across the agricultural product space is explored in Figure 6.6. The size of the nodes for each product is proportional to its *PCI*. The figure reveals that even products located in the sparser parts of the network may embed a relatively high level of complexity. See, for instance, the location of paper products and some meat and wood products. This is a somewhat different picture than the product space for all economic sectors which shows that the more complex products are clustered in the denser parts of the network (see Hausmann *et al*., 2011). However, as the preceding analysis shows, the relationship between complexity and centrality are a bit more nuanced within the agro-complex.

Figure 6.6 below also shows the Product Complexity Index (*PCI*) for each of the 48 product groups shown in the agricultural product space. Note that these are average values, so the variation of the *PCI* within the respective product groups can be significant. 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 first two product groups embed different stages of processing. The other three product groups fall under the corresponding categories of machinery and chemicals, as used in Hausmann *et al.* (2011), which are shown to have high levels of complexity relative to all other economic sectors in their analysis. The least complex product groups are vegetable plaiting material, natural rubber, tobacco products, cacao products, and vegetable fibres. These product groups mainly encompass agricultural products from the tropics.

Product group	PCI	Product group	PCI
Livestock	0.63	Essential oils, tanning and dying extracts	-0.51
Meat	0.59	Albumins, starches and enzymes	0.68
Fish	-0.01	Natural rubber	-2.15
Diary products	0.64	Raw hides, skins and leather	-0.34
Other animal products	-0.46	Articles of leather	0.22
Flowers, plants and trees	0.70	Fur skins	0.43
Vegetables	-0.06	Wood and articles of wood	0.40
Fruit	-0.19	Cork and articles of cork	0.51
Coffee, tea & spices	-0.50	Manufacturers of plaiting materials	-0.02
Cereals	0.26	Pulp of wood	1.00
Cereal products	0.19	Paper and paperboard	0.62
Seeds (oilseeds, sowing seeds, oleaginous fruits)	-0.17	Wool	0.55
Vegetable extracts and saps	1.17	Cotton	0.12
Vegetable plaiting material	-2.98	Vegetable fibres	-0.56
Animal and vegetable fats, oils	-0.14	Felt, ropes, cables (of natural fibres)	0.72
Preparations of meat or fish	0.49	Carpets (of natural fibres)	0.64
Sugar and sugar products	-0.28	Woven, knitted and crocheted fabrics (of natural fibres)	0.51
Cacao and cacao products	-0.58	Clothing and garments (of natural fibres)	-0.18
Food preparations of cereal	0.40	Other textiles (of natural fibres)	-0.11
Food preparations of fruit, vegetables and nuts	0.28	Tractors, agricultural machinery and equipment	0.99
Other food preparations	0.15	Machinery for agro-processing and food manufacturing	0.95
Beverages and spirits	0.09	Fertilisers	0.82
Food residues	-0.36	Insecticides, pesticides and biocides	0.12
Tobacco	-0.81	Wooden furniture	0.44

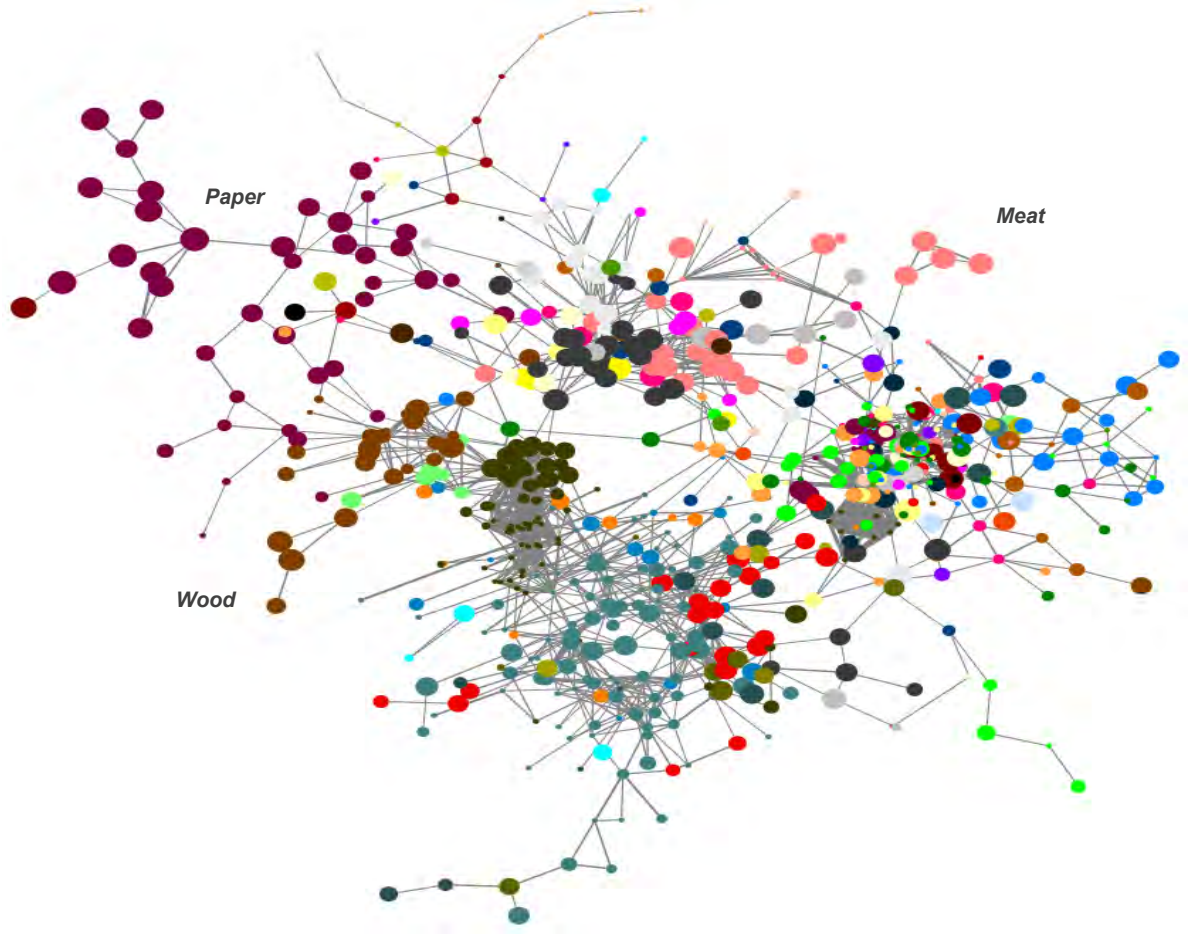


Figure 6.6: The level of complexity in the agricultural product space
Source: Author's own calculations (2013)

To elaborate further on the product complexity, Table 6.1 provides an overview of the ten most and ten least complex products in the agro-complex. The majority of the most complex

products are from the forestry cluster and comprises processed paper. Remarkable is the featuring of rye, a primary product, among the most complex products. This specialty grain crop is only grown in a relatively small number of countries and is used in a variety of bakery and health products. Processed flax features twice among the most complex products. This is also a speciality crop grown in relatively few countries for its fibres (e.g. linen) and oil (e.g. linseed oil).

The least complex products are dominated by primary agricultural products. This thus corresponds with Figures 6.3 and 6.4. Two of these primary agricultural products, sisal and copra, are tropical products, while the other two are berries and vegetables from more moderate climatic regions. Another product that features predominant in the bottom ten is processed rice.

Table 6.1: Overview of the most and least complex products in the agro-complex

Top 10 products			
HS code	**Product**	**Cluster**	**PCI**
481022	Light-weight (kaolin) coated paper	Forestry	1.60
480240	Wallpaper base	Forestry	1.53
480261	Paper and paperboard: >10% mech. fibres, in rolls	Forestry	1.52
100200	Rye	Primary agriculture	1.50
481410	Ingrain paper	Forestry	1.49
481031	Kraft paper & paperboard, other purps. coated,	Forestry	1.44
843330	Haymaking machinery	Agricultural inputs	1.39
530121	Flax, broken/scotched	Agro-processing: non-food	1.39
530129	Flax, hackled / processed	Agro-processing: non-food	1.39
843353	Root/tuber harvesting machinery	Agricultural inputs	1.35
Bottom 10 products			
HS code	**Product**	**Cluster**	**PCI**
530410	Sisal & other Agave textile fibres, raw	Primary agriculture	-6.15
530490	Sisal& other Agave textile fibres, processed, tow	Agro-processing: non-food	-6.15
070910	Globe artichokes, fresh/chilled	Primary agriculture	-5.04
081030	Black/white/red currants & gooseberries, fresh	Primary agriculture	-5.04
230650	Oil-cake & solid residues of copra/coconut	Agro-processing: food	-3.66
120300	Copra	Primary agriculture	-2.99
050900	Natural sponges of animal origin	Agro-processing: non-food	-2.99
110230	Rice flour	Agro-processing: food	-2.99
140300	Vegetable mats, brooms/brushes	Agro-processing: non-food	-2.99
230220	Bran / sharps / residues derived fr the mil of rice	Agro-processing: food	-2.99

Source: Author's own calculations (2013)

The highest complexity index within the agro-complex is 1.60. Relating this index to the highest *PCI* of 2.27 for specialised machineries, as calculated by Hausmann *et al.* (2011) who included all products in their sample, it is evident that the agro-complex is not embedded with the most advanced productive knowledge. However, considering the spread of complexity, ranging from -6.15 to 1.60, the scope for upgrading within the agro-complex is apparent.

A complete overview of the most and least complex products per cluster is provided in Annexure II. Table A.3 shows the levels of complexity for primary agriculture. The 15 most complex products are dominated by seeds for sowing, whereas the bottom 15 are dominated by products from tropical agriculture. The top and bottom 15 products for agro-processing of food are shown in Table A.4. The most complex products in this cluster consist mainly of meat products, and the least complex products are dominated by vegetable fats and oils. Table A.5 depicts the product-level complexity within the agro-processing of non-food cluster. The top 15 are dominated by flax products and the bottom 15 are dominated by a variety of vegetable fibres and garments of natural fibre. The most and least complex products in the forestry cluster are shown in Table A.6 The top 15 consist mainly of processed paper products, whereas the bottom 15 consist predominantly of semi-processed wood products, as wells as paper products. The level of complexity within the agricultural input cluster is illustrated by Table A.7. The most complex products in this specific cluster mainly consist of agricultural machinery. The least complex products are predominantly plant protection products, poultry keeping, and milling equipment. However, most of the products listed among the least complex agricultural inputs have an above-average *PCI*.

6.3.4 The complexity of South Africa's agricultural products

This section will analyse the level of complexity of South Africa's agricultural production by means of the Product Complexity Index (PCI). This will provide valuable insights into the potential for upgrading, which will be further explored in the next section. In Figure 6.7 below, the level of complexity of South Africa's international trade in the agro-complex is assessed for each of the five clusters. Since South Africa exports 89 per cent and imports 88 per cent of the products included in the agro-complex, the use of a simple average of the

PCI would yield an inappropriate reflection of the underlying level of complexity. Hence, the level of specialisation in either exports or imports is taken into account by averaging the *PCI* of those products with an *RCA* index (for exports) or an *RMA* index (for imports) of equal to or larger than 1[37] (see Section 3.5.3 for the calculation of these indices). Apart from this measure of the average *PCI* for both exports and imports, the figure also indicates the spread of complexity by depicting the minimum and maximum level. Furthermore, the maximum value of the y-axes reflects the upper bound of complexity within that cluster.

The broad picture that emanates from Figure 6.7 below is that for all of the five clusters, the average level of product complexity for imports is higher than for exports. This implies a negative trade balance with regard to complexity, which is cumbersome as the reverse situation would be considerably more favourable for economic development. Furthermore, since a significant proportion of imports in the agro-complex are being re-exported (see Section 3.6.2), it could have been expected that this would boost the product-level complexity of exports. Hence, the current status of South Africa's agro-product complexity in international trade should be improved by either moving to new and more complex export products or substituting those specific imports with high levels of complexity by local production. The figure shows that the difference between South Africa's complexity level of imports and exports is the smallest for primary agricultural products and the largest for agricultural inputs. Considering the spread of export complexity (i.e. high maximum, low minimum), the most potential for increasing the product-level complexity of exports exists within the agro-processing of food cluster.

[37] These indices were calculated for the period 2009-2011.

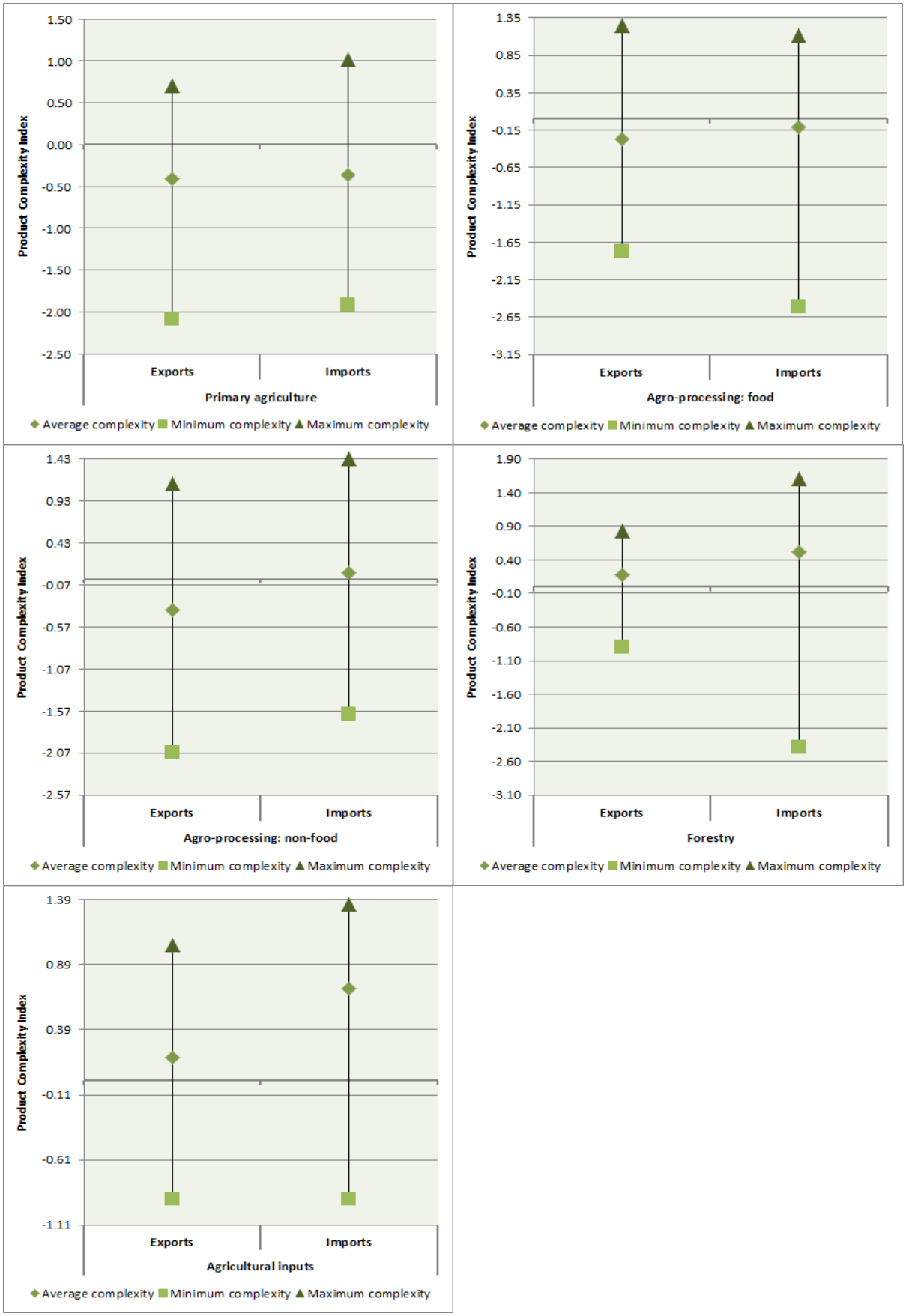


Figure 6.7: Product complexity of South Africa's international trade in the agro-complex

Source: Author's own calculations (2013)

The assessment in Figure 6.7 provides some valuable realities on the level of complexity of South Africa's international supply and demand of products in the agro-complex. However, it does not capture any information on South Africa's complexity level of the productive capabilities as embedded in local production. South Africa's specialisation (i.e. competencies) of production in the agro-complex is measured by the *RTA* index (see also Section 5.3.1). An *RTA* of between 0 and 1 reveals a low product-level specialisation, whereas an *RTA* of equal to or higher than 1 implies a high degree of specialisation (i.e. core competency). This information is used to compile Figure 6.8 below, which depicts the product-level complexity of production in the different clusters. The figure also distinguishes between the levels of specialisation in production.

The broad conclusion that can be derived from Figure 6.8 is that products for which South Africa has a relatively high level of specialisation (i.e. core competencies) are generally less complex than the products for which it has a low level of specialisation. This implies that the country's core competencies in the agro-complex are comprised of production, which requires less sophisticated productive capabilities. This also corresponds with the relatively low global country-ranking of South Africa based on the *Agricultural Complexity Index* (see Section 6.3.2).

Figure 6.8 also shows that South Africa's productive structure in the agro-complex does include some products with relatively high levels of complexity. In the agro-processing of food and non-food clusters, especially, South Africa has built core competencies around products with a high level of complexity. These cases can be a blueprint for the upgrading of the productive capabilities for other products within those clusters. These may include chenille fabrics of cotton, berries, cereal flakes, preserved apricots, mixtures of nitrate, bovine leather, non-chemically obtained paper, and paperboard.

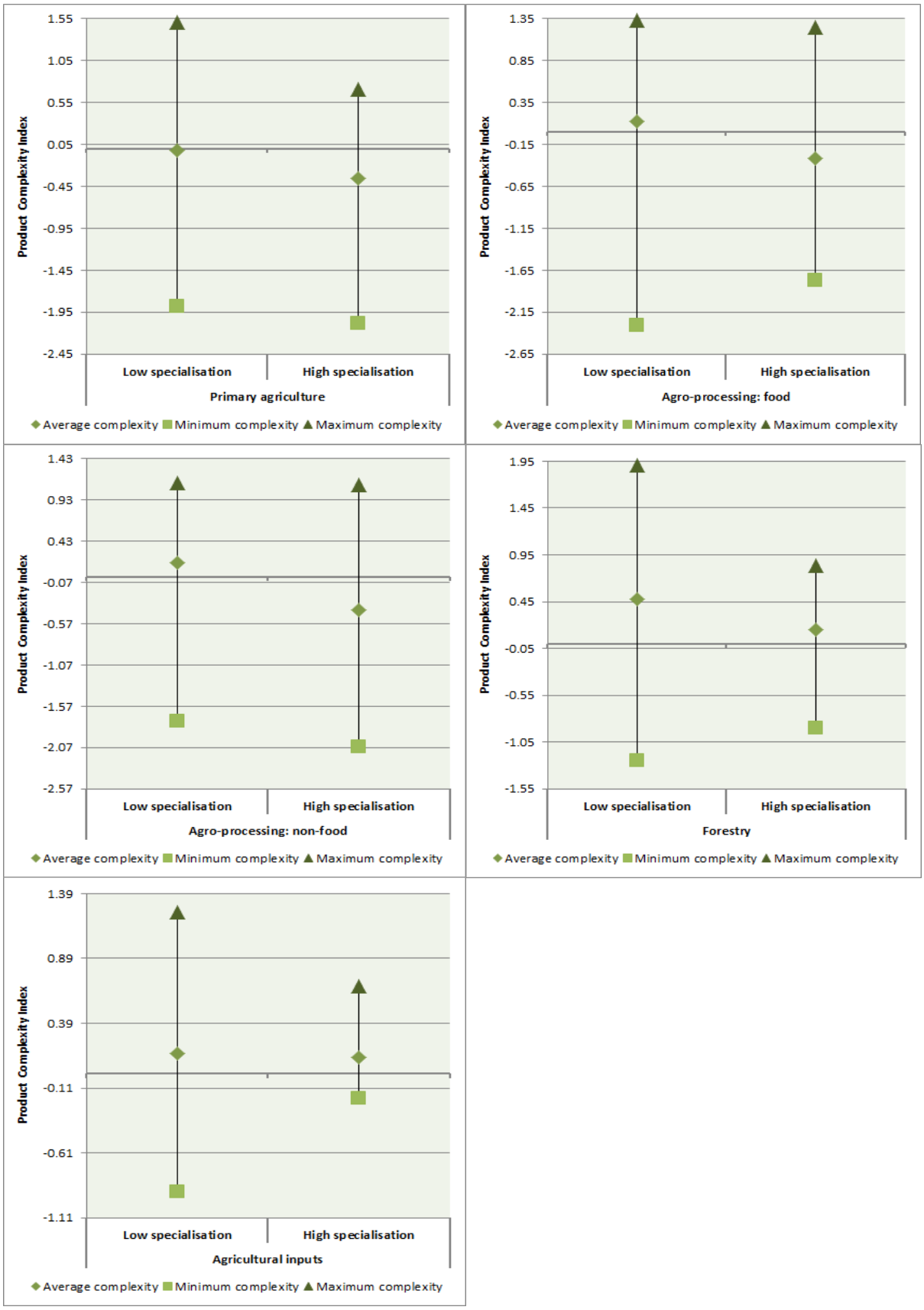


Figure 6.8: Product complexity of South Africa's production in the agro-complex

Source: Author's own calculations (2013)

The advancement from moving from a low to high level of specialisation in the forestry and agricultural inputs clusters will potentially have the highest impact on increasing the complexity of South Africa's core competencies. A significant proportion of the products in those clusters have a low level of revealed specialisation, combined with a high level of complexity (see Figure 6.8). The average level of complexity of the core competencies in those specific clusters will simply increase if South Africa focuses on further developing these specific products.

An overview of the most complex core competencies in South Africa's agro-complex is provided in Table 6.2 below. A more comprehensive list of all products with an above average complexity can be found in Table A.8 in Annexure II. South Africa is thus relatively specialised in the production of these specific products, which is reflected be an *RTA* index of equal to or larger than 1. Apart from the *PCI* per product, the table also provides some perspective on the type of product and whether it is located in the agricultural product space. As mentioned, these products can be used as best-practices for upgrading.

The categorisation of the type of product as either a niche or mass product is based on the product's share in global agricultural trade for the period 2009 to 2011. It is assumed that niche products have a below average share, and mass products an above average share, in global trade. This categorisation sheds some light on the market scope of production. It is evident that most products in Table 6.2 are niche products. Furthermore, 77 per cent of all products in the agro-complex for which South Africa has developed core competencies are classified as niche products.

Owing to the restrictions on the degree of relatedness (i.e. proximity) between products in the agricultural product space, not all products are included (see also Section 5.2.1). These restrictions assure that only meaningful product-to-product connections are included. Hence, products which present limited opportunities for diversification by transferring existing capabilities to new products are excluded from the agricultural product space. This inclusion or exclusion is reflected in the last column of Table 6.2[38].

[38] South Africa has developed core competencies in the production of 172 products in the agro-complex. Seventy of these are also located in the agricultural product space.

Table 6.2: Overview of South Africa's most complex core competencies in the agro- complex (top 15)

#	HS code	Product	Cluster	PCI	Type of product	Located in the agricultural product space?
1	020736	Meat & edible meat offal of ducks/geese/guinea fowls, frozen	Agro-processing: food	1.25	Niche product	Yes
2	160412	Herrings, prepd./presvd., whole/in pieces	Agro-processing: food	1.13	Niche product	Yes
3	430110	Raw furskins, of mink, whole, with/without head/tail/paws	Agro-processing: non-food	1.11	Mass product	Yes
4	190420	Prepared foods obt. from unroasted cereal flakes/mixts. of unroasted cereal flakes & roasted cereal flakes/swelled cereals	Agro-processing: food	1.00	Niche product	Yes
5	470620	Pulps of fibres derived from recovered (waste & scrap) paper/paperboard	Forestry	0.83	Niche product	No
6	470311	Chemical wood pulp, soda/sulphate, other than dissolving grades, unbleached, coniferous	Forestry	0.82	Niche product	Yes
7	470329	Chemical wood pulp, soda/sulphate, other than dissolving grades, semi-bleached/bleached, non-coniferous	Forestry	0.82	Mass product	No
8	580126	Chenille fabrics of cotton	Agro-processing: non-food	0.81	Niche product	Yes
9	410330	Raw hides & skins of swine (fresh / salted / dried / limed/pickled/othw. presvd. but not tanned/parchment-dressed/furth. prepd.)	Agro-processing: non-food	0.77	Niche product	No
10	200850	Apricots, prepd./presvd., whether or not cont. added sugar/oth. sweetening matter/spirit, n.e.s.	Agro-processing: food	0.72	Niche product	Yes
11	081040	Cranberries, bilberries & oth. fruits of the genus Vaccinium, fresh	Primary agriculture	0.71	Niche product	Yes
12	410791	Leather furth. prepd. after tanning/crusting, incl. parchment-dressed leather, of bovine (incl. buffalo)/equine animals, without hair on, other than whole hides & skins, full grains, unsplit	Agro-processing: non-food	0.70	Niche product	Yes
13	310260	Double salts & mixts. of calcium nitrate & ammonium nitrate	Agricultural inputs	0.68	Niche product	Yes
14	410792	Leather furth. prepd. after tanning/crusting, incl. parchment-dressed leather, of bovine (incl. buffalo)/equine animals, without hair on, other than whole hides & skins, grain splits	Agro-processing: non-food	0.67	Mass product	No
15	480256	Paper & paperboard, not cont. fibres obt. by a mech./chemi-mech. process...in sheets with one side not >435mm...	Forestry	0.65	Mass product	Yes

Source: Author's own calculations (2013)

It is evident from Table 6.2 that the majority of South Africa's most complex products which it specialises in are located in the agricultural product space and thus have relatively good prospects as a starting point for diversification. This observation also holds for South Africa's core competencies with an above average level of complexity (see Table A.8 in Annexure II).

The top 15 products, as depicted in Table 6.2, are relatively balanced between forestry, agro-processing of food, and non-food products. Agricultural inputs and primary agriculture only feature marginally in this specific list. However, considering all (67) products with an above average level of complexity, as depicted in Table A.8 in Annexure II, the list is dominated by processed food products, followed by primary agricultural products, forestry products, processed non-food products and lastly agricultural inputs.

Overall, it can be concluded that the level of complexity (i.e. the diversity of useful productive knowledge) of South Africa's core competencies in the agro-complex is mainly determined by processed food products, which are located in the agricultural product space and are produced for niche markets. Since Figure 6.3 revealed that the most complex productive capabilities could be derived from forestry products and agricultural inputs, there seems to be a complexity disparity in South Africa's core competencies.

The disparity between South Africa's productive knowledge embedded in its core competencies and the general level of complexity in the five clusters is further explored in Figure 6.9 below. The complexity of South Africa's productive capabilities is measured here by applying an *RTA* weight on the Product Complexity Index (*PCI*) of all products in the agro-complex for which South Africa has a revealed specialisation (478)[39]. Subsequently, this weighted PCI is summed for each cluster. This provides an improved reflection of the level of embedded productive knowledge in the agro-complex as it considers the absolute level of specialisation. The general level of complexity per cluster is determined by the respective median of the *PCI* for all products in the cluster. Since the *PCI* is not normally distributed and negatively skewed (see also Figure 6.3), the median is a more representative indicator of complexity levels measured over all products.

[39] This implies having an RTA index of more than zero. Thus, this comprises both products with a low and high level of specialisation.

It is evident from Figure 6.9 that all clusters show a complexity gap. This gap is the largest within the agro-processing of food cluster, followed by agricultural inputs, and forestry. The complexity gap within the agro-processing of food cluster is the smallest, followed by primary agriculture. Given the fact that South Africa also has the highest levels of specialisation in these two clusters[40], the potential for closing this gap is favourable. However, an increase in the complexity of South Africa's overall productive structure in the agro-complex can only be reached by capitalising the upgrading opportunities within the forestry and agricultural input clusters.

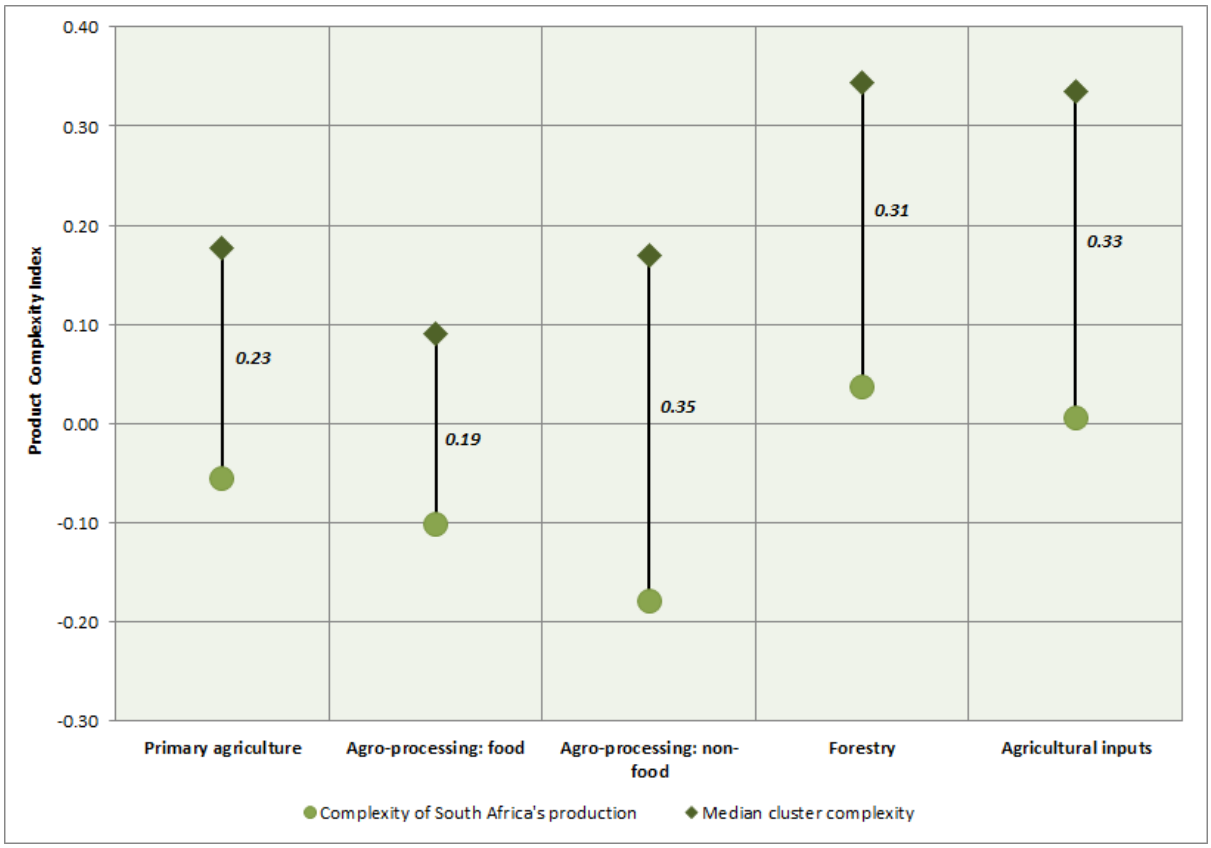


Figure 6.9: Complexity gap of South Africa's production in the agro-complex
Source: Author's own calculations (2013)

Figure 6.9 does not reveal any information on the product-level orientation of South Africa's production towards complexity. Hence, the relationship between South Africa's product-level specialisation and the Product Complexity Index (PCI) is shown in Figure 6.10. Twenty

[40] Sum of RTA indices per cluster: primary agriculture (189), agro-processing of food (167), agro-processing of non-food (37), forestry (-74), agricultural inputs (-71).

per cent of South Africa's products in the agro-complex have an *RTA* index of more than zero and an above average level of complexity. Taking this further, only five per cent (67) of all products have a high level of specialisation (i.e. *RTA* >1) and an above average complexity.

Given the negative slope of the fit line, the more complex products reveal a relatively lower level of specialisation. Since it is favourable for a country's economic development to be more specialised in products with a relative high level of complexity, a positive sloping fit line should be inherent.

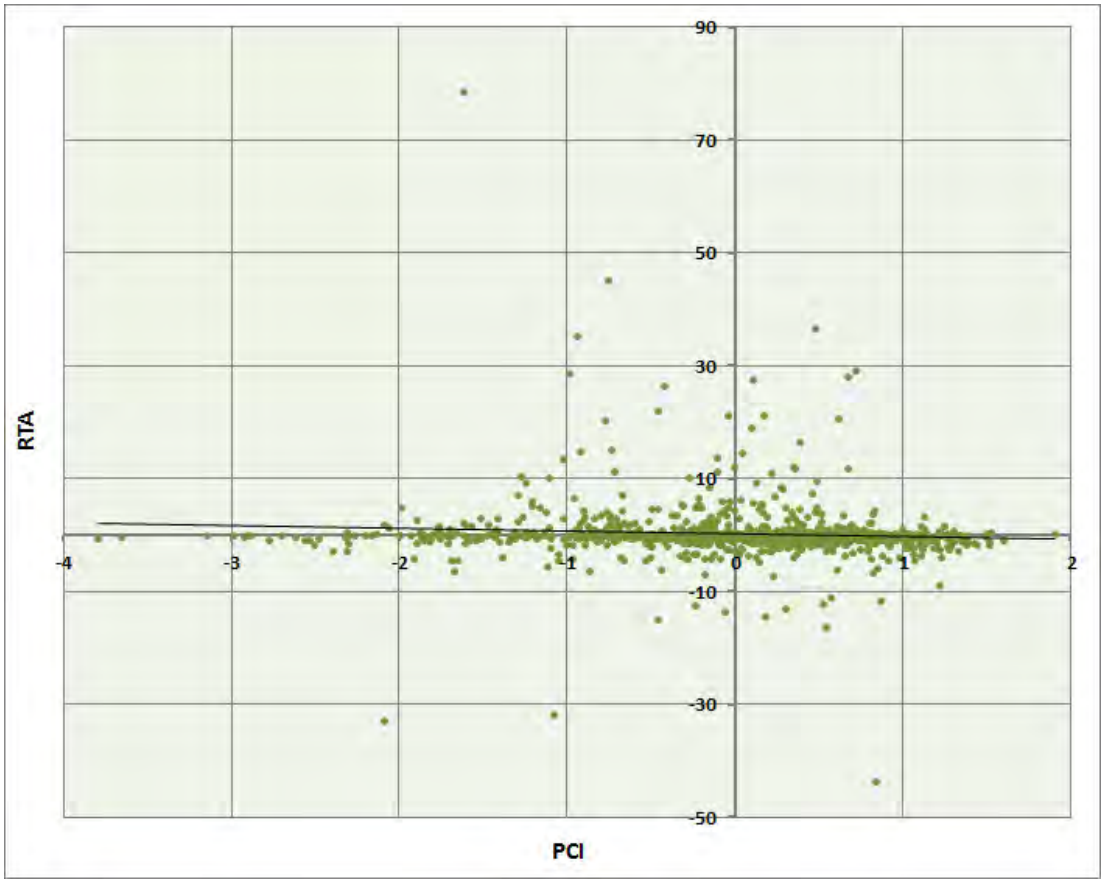


Figure 6.10: South Africa's product-level orientation towards complexity
Source: Author's own calculations (2013)

Statistical analysis of the relationship between the level of complexity and South Africa's specialisation shows a negative and significant correlation. This is reflected by a Pearson correlation coefficient of -0.08, which is significant at the 0.001 level. The relationship is

relatively weak but nevertheless it indicates an unfavourable position of South Africa's core competencies in the agro-complex towards the level of product complexity.

6.3.5 Upgrading within South Africa's agro-complex

South Africa's current position in the agricultural product space determines its diversification opportunities to nearby products. The degree to which these diversification opportunities hold any potential for the structural transformation (i.e. diversification to more complex products) of South Africa's productive structure is analysed in this section.

Section 5.3.3 showed that, given South Africa's current productive structure in the agro-complex, a total of 217 diversification opportunities emerge from the agricultural product space. Figure 6.11 below shows the productive structure of South Africa, reflected by the red diamonds, and its connections to these diversification opportunities within the context of product complexity[41]. The left pane in the figure shows the pathways for diversification on the basis of South Africa's core competencies (i.e. high level of specialisation) and the right pane show these for the country's overall productive structure in the agro-complex. The size of the nodes in the network is proportional to the respective *PCI* of that product. The figure reveals that South Africa does have some connections to products with a relatively high level of complexity.

[41] This network was laid-out using the Fruchterman-Reingold force-directed algorithm (Fruchterman and Reingold, 1991).

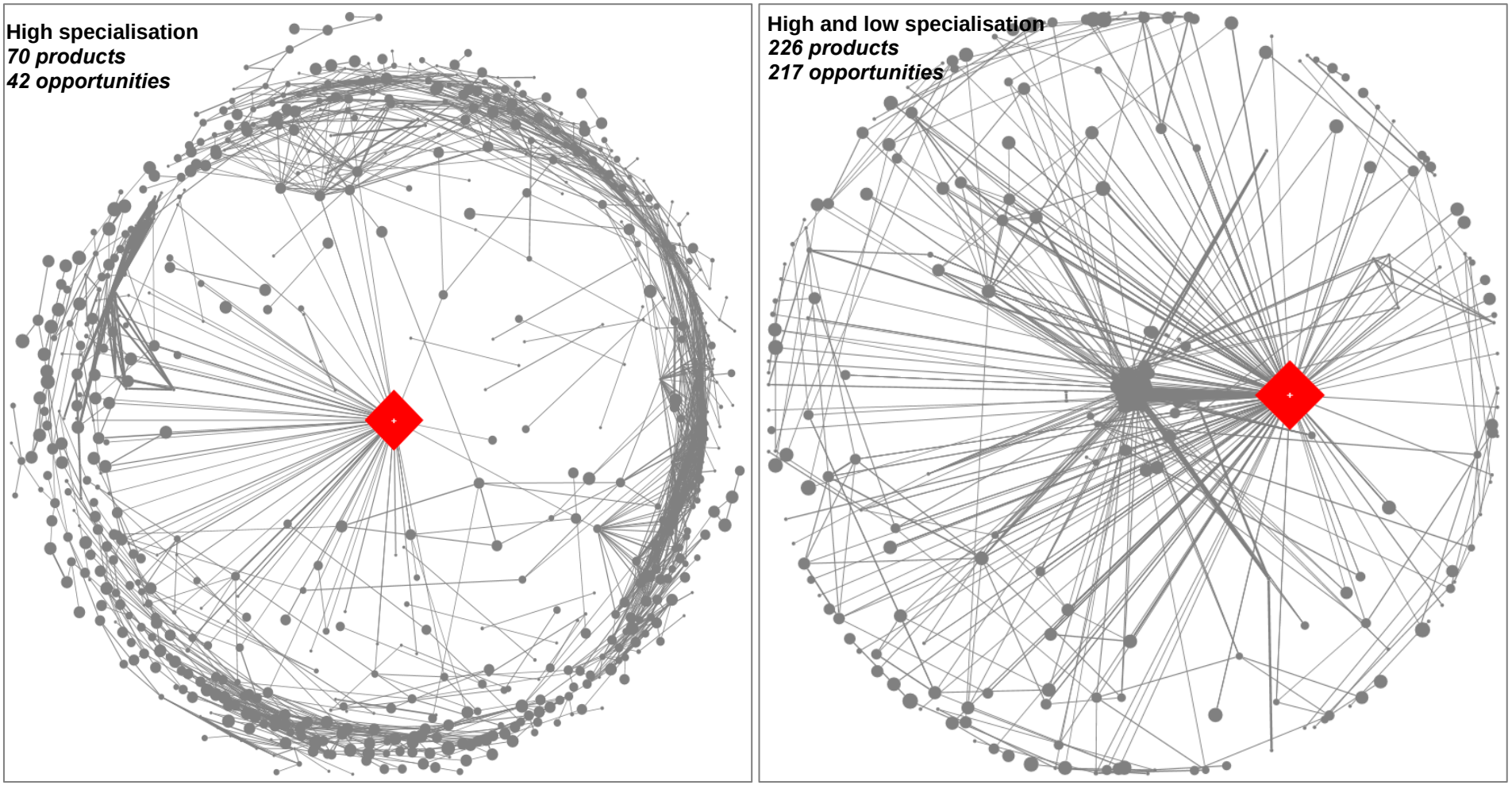


Figure 6.11: South Africa's productive structure and the level of complexity in the agricultural product space

Source: Author's own calculations (2013)

To estimate the closeness of South Africa's current productive structure in the agro-complex to new and more complex products, the measure of *opportunity value* is applied (see also Section 4.3.4). This index is calculated for each "new" product in the agricultural product space, both on the basis of the distance to South Africa's core competencies and the distance to the overall productive structure. The measure reflects the "value" contribution of each possible diversification opportunity to the process of structural transformation (i.e. the upgrading of the agro-complex).

The *opportunity value* is used to draw an opportunity network for South Africa's productive structure. The opportunity network for the country's core competencies is depicted in Figure 6.12 below. The large red central node represents these core competencies and the individual nodes each represent one of the 60 diversification opportunities. The sizes of these individual nodes are proportional to their *opportunity value*. The labels correspond to the respective product code at the six-digit level of the Harmonised System.

The opportunity network of the core competencies indicate significant differences in the opportunity value of the different pathways for diversification. Most of the opportunities have a single pathway, whereas a few have inter-linkages. The latter implies that a transfer of productive capabilities from existing production to these "new" products will have more strategic value. Overall, the products with a relatively high *opportunity value* in this specific network can be considered as "low hanging fruits" for structural transformation in the agro-complex, owing to their relatedness to the country's core competencies.

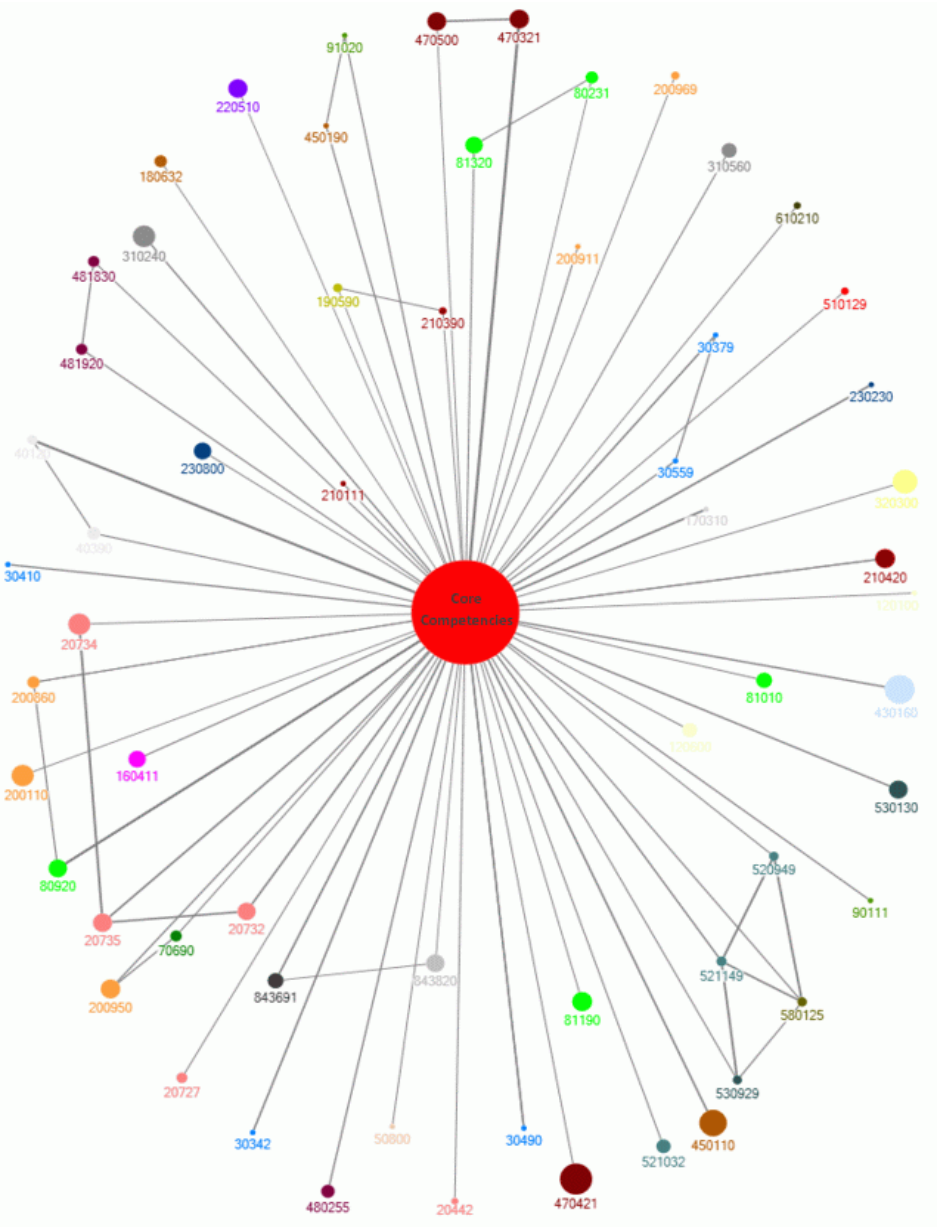


Figure 6.12: Opportunity network from South Africa's core competencies in the agro-complex

Source: Author's own calculations (2013)

South Africa's opportunity network for its overall productive structure in the agro-complex is shown in Figure 6.13 below. A total number of 217 diversification opportunities are included in this specific network. It is evident from this specific network that its pathways of diversification are more interrelated. These interrelated products form opportunity clusters which will be further explored and identified in Section 6.3.6.

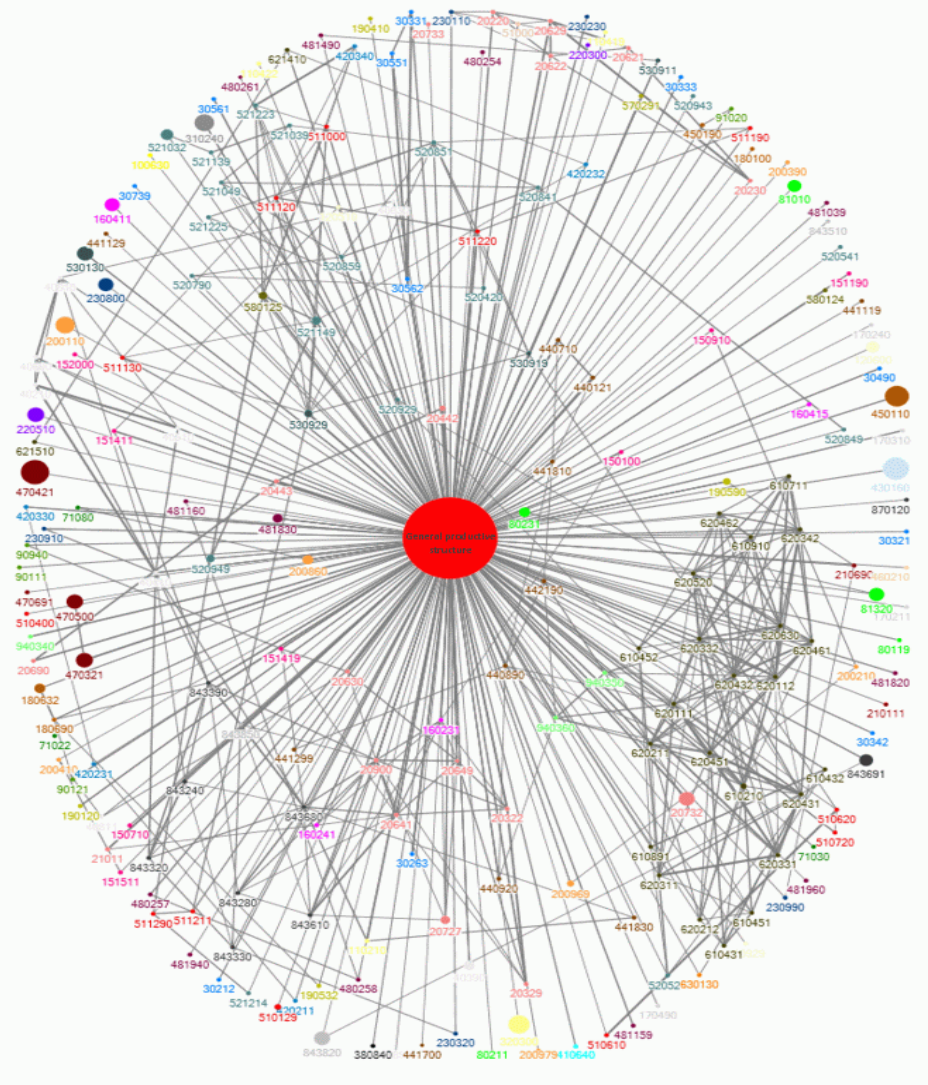


Figure 6.13: Opportunity network of South Africa's general productive structure in the agro-complex

Source: Author's own calculations (2013)

The position of South Africa's diversification opportunities in the agricultural product space is summarised in Figure 6.14 below. The number of opportunities per agricultural cluster, stemming from its overall productive structure, is represented by the size of the bubbles. The average distance (refer to Section 4.2.4 for the measure of *Distance*) of the opportunities in each cluster to the country's current productive structure is plotted on the x-axis. Furthermore, the average *opportunity value* of the opportunities in each cluster is plotted on the y-axis. The figure reveals that most diversification opportunities exist in the agro-processing of food cluster. This cluster also has a relatively high level of *opportunity value* which is favourable for structural transformation in South Africa's agro-complex.

Furthermore, the diversification opportunities in this cluster are all relatively "close" to current production.

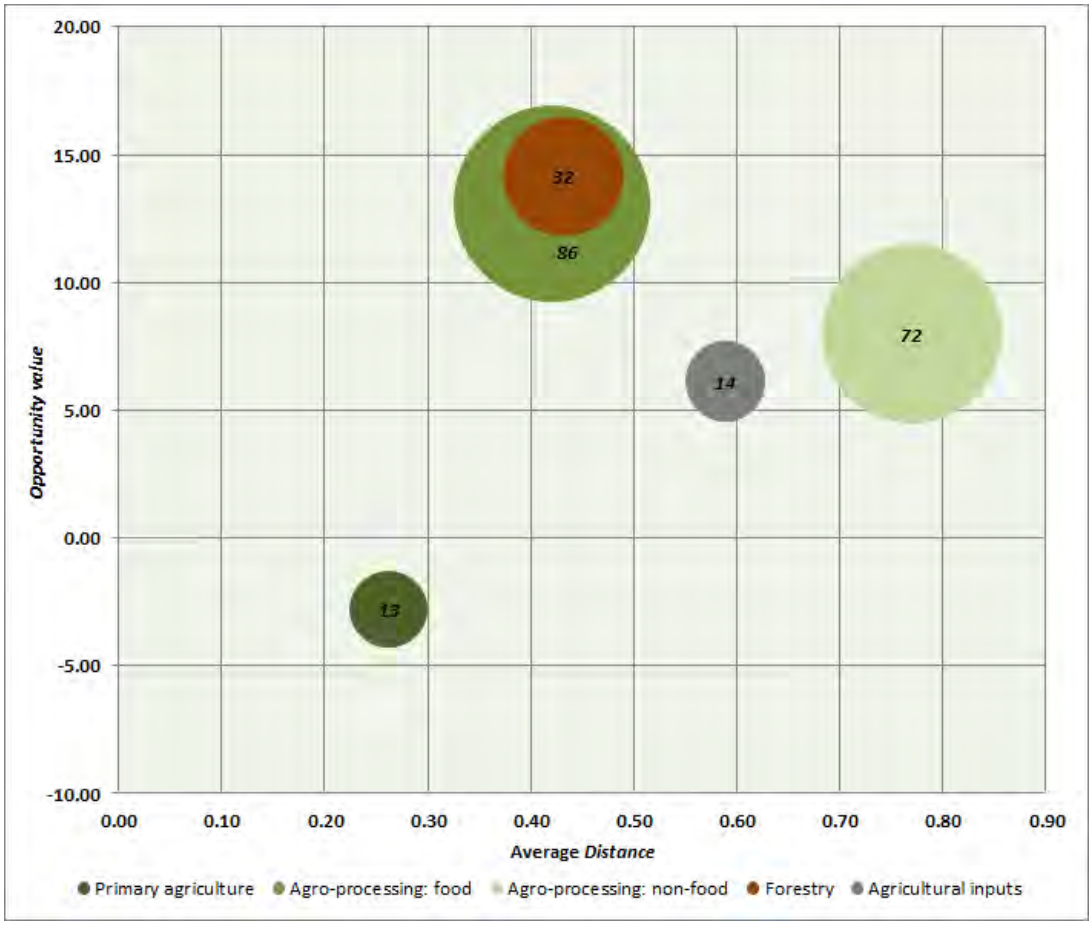


Figure 6.14: South Africa's diversification spectrum for structural transformation in the agricultural product space

Source: Author's own calculations (2013)

Apart from the agro-processing of food cluster, Figure 6.14 shows that the forestry cluster also has a promising potential for raising South Africa's level of complexity in the agro-complex. However, its total number of diversification opportunities is average.

Figure 6.14 shows, furthermore, that although the opportunities in primary agriculture are relatively close, they are few. They also hold little strategic value for upgrading South Africa's productive structure. Similarly, the country's diversification opportunities in agricultural inputs are few, although they have more strategic value for upgrading. The

diversification opportunities in agro-processing of non-food are abundant but located relatively "far" away from South Africa's production frontier.

As discussed, the level of South Africa's specialisation of the products connected to the diversification opportunities are an important determinant for the ease of moving to these "new" products. Furthermore, the distance to the country's current production, which encompasses the proximity between products, is also an important factor for the simplicity of diversification and upgrading. Therefore, Figure 6.15 (A-E) explores the product-level relationship between distance and complexity for each of the diversification opportunities per cluster. The opportunities which originate from the country's core competencies are coloured in dark-green and the opportunities stemming from the overall productive structure are coloured green.

Figure 6.15 reveals also that the direction of the relationship between the distance and the level of complexity differs among the clusters. For agricultural inputs, primary agriculture and agro-processing of food, this relationship is positive which implies that upgrading is more difficult, as the more complex products are located further away from the production frontier. For forestry and agro-processing of non-food, the opposite is the case. However, further analysis of this relationship by examining the goodness of fit of the fit line shows little explanatory power, as reflected by the low values of the respective R-squares. The distance of the more complex diversification opportunities in the agricultural product space in relation to the country's productive structure is not a determinant of structural transformation in South Africa's agro-complex.

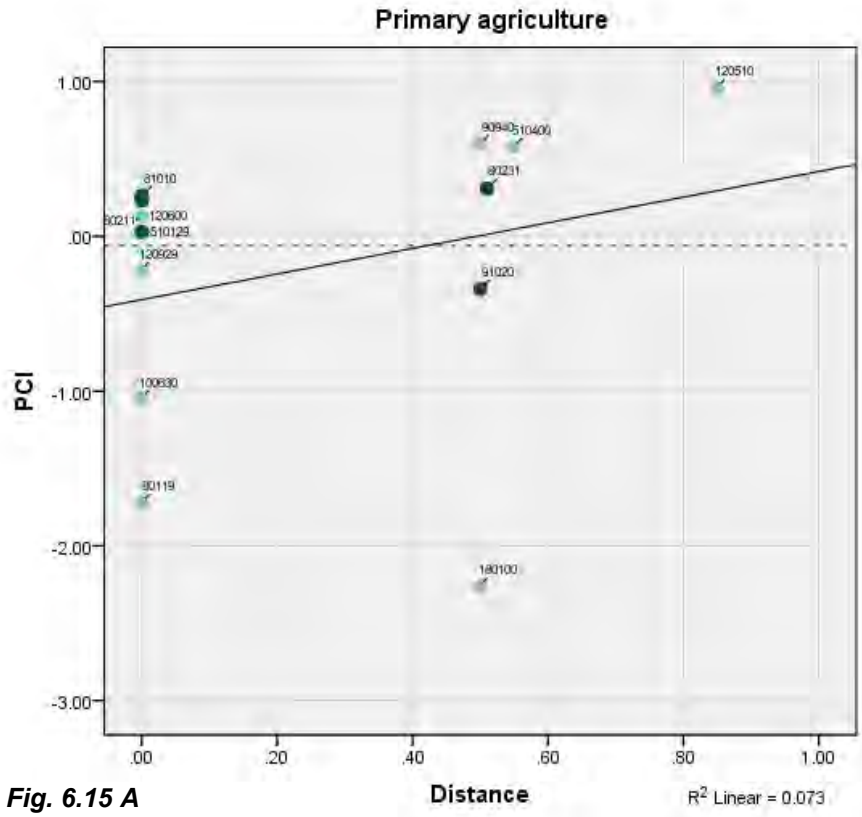


Fig. 6.15 A

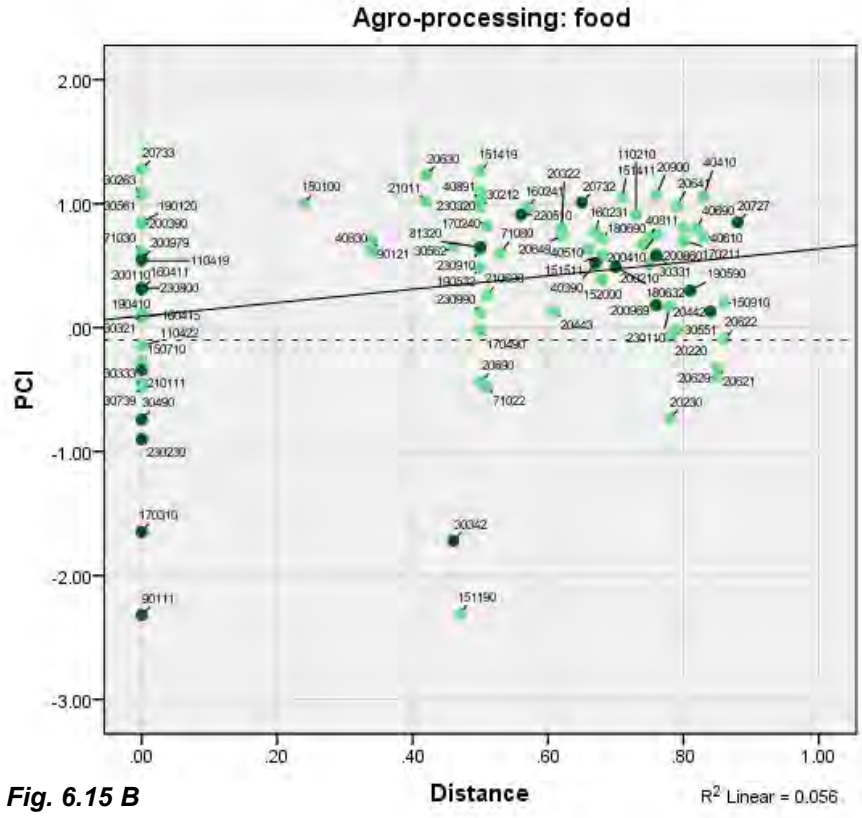


Fig. 6.15 B

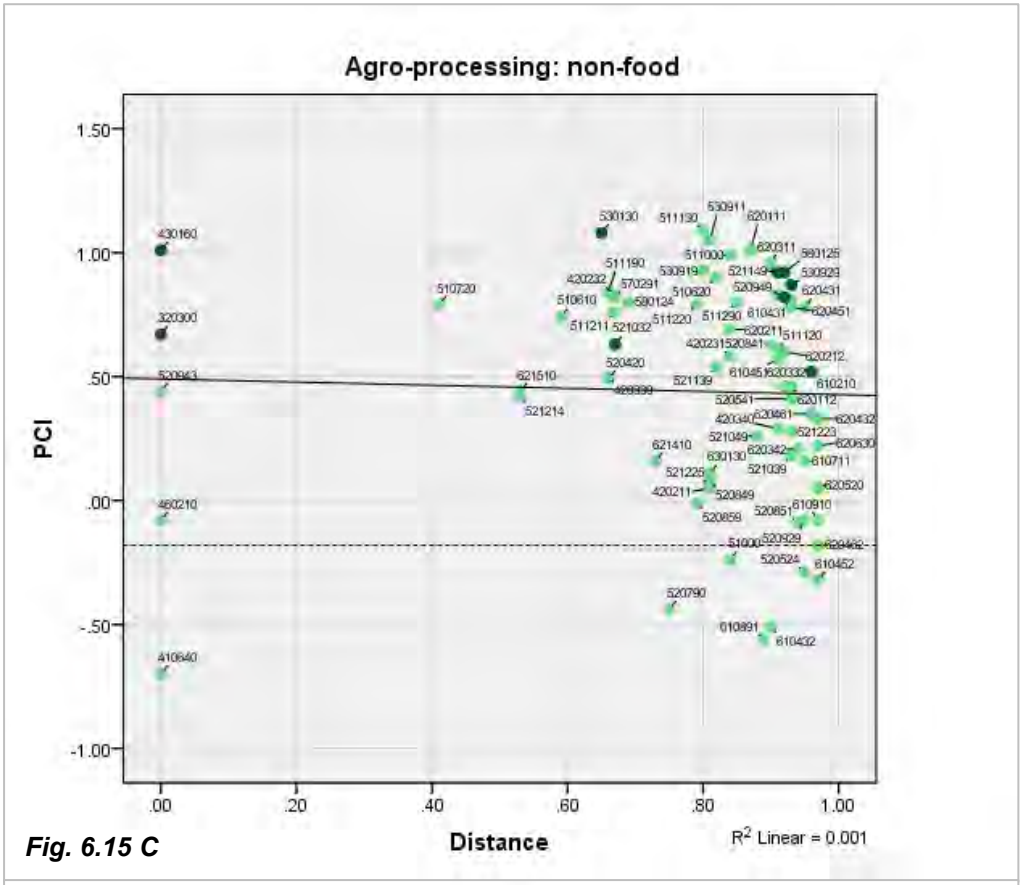


Fig. 6.15 C

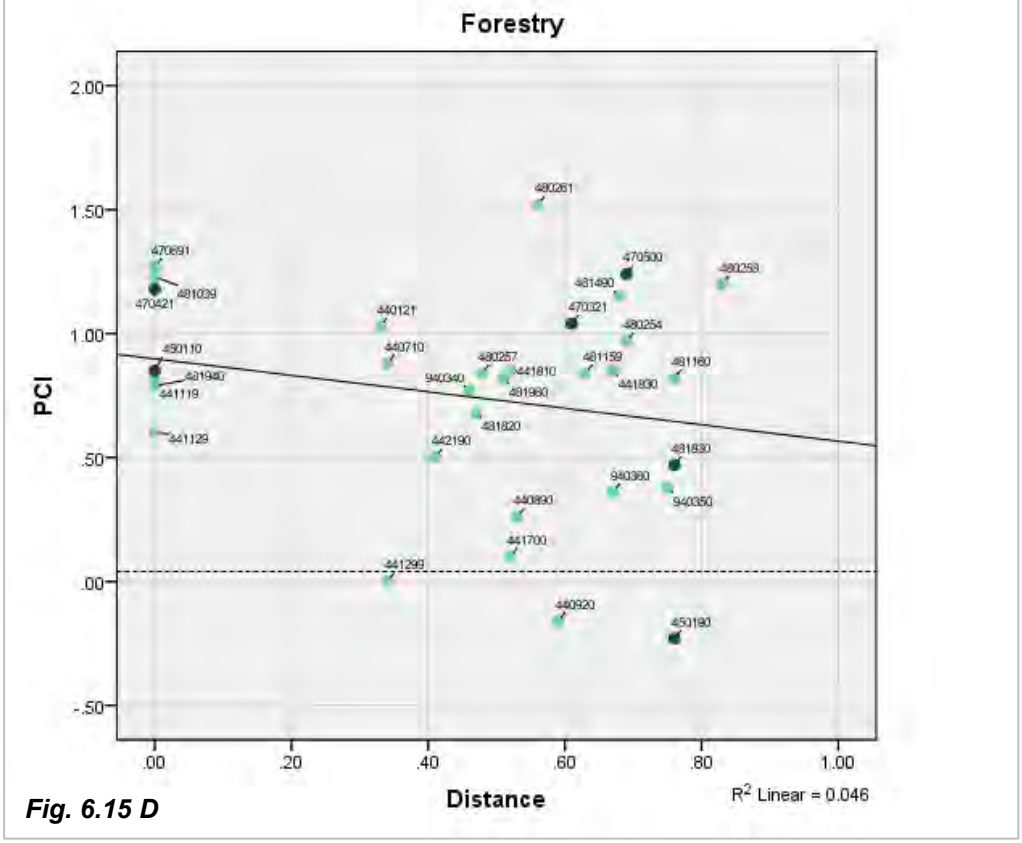


Fig. 6.15 D

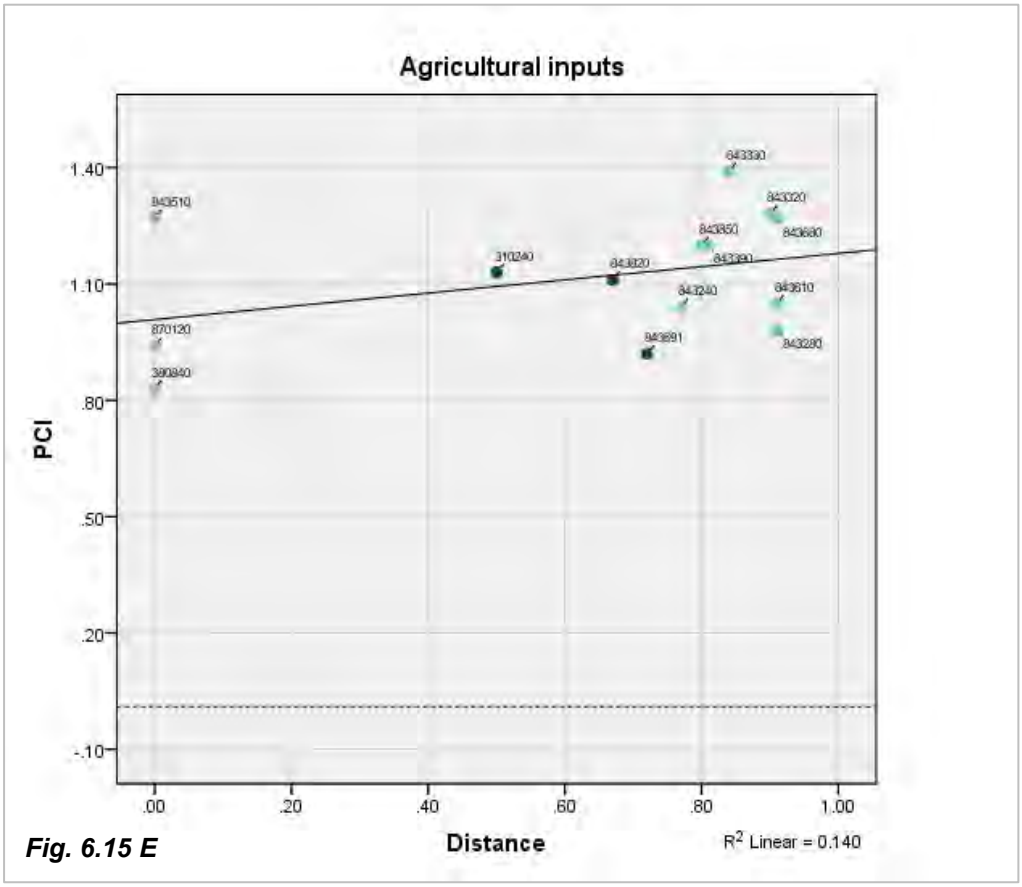


Figure 6.15 A-E: Product-level upgrading spectrum for South Africa's agro-complex
Source: Author's own calculations (2013)

Figure 6.15 also shows the respective product code of the Harmonised System for each diversification opportunity. The top ten of these opportunities, based on the *opportunity value*, are shown in Tables 6.3 and 6.4. Table 6.3 shows the opportunities based on the core competencies, whereas Table 6.4 depicts the opportunities based on the general productive structure. Diversification opportunities stemming from the country's core competencies which are already produced at a low level of specialisation are depicted in bold in Table 6.3. Furthermore, the diversification opportunities stemming from South Africa's core competencies in Table 6.4 are underlined.

The left parts of the tables show the diversification opportunities and indicate the product cluster, the *opportunity value,* and whether or not the product holds strategic value. If the *Product Complexity Index* (PCI) of the product is higher than the average complexity of its respective cluster, the product has a positive strategic value. Hence, diversifying to such a

product will contribute to structural transformation in South Africa's agro-complex. Of the diversification opportunities stemming from the country's core competencies, 77 per cent have a positive strategic value.

The right parts of the tables indicate the origin of diversification for each of the opportunities. These are the products currently produced by South Africa to which the opportunity is linked. Hence, they can be regarded as the source of the capability and knowledge transfer. The product cluster for each of these "source products" is indicated, as well as a typology of the productive relationship with the diversification opportunity.

Section 4.2.3 showed that the measure of proximity between products is a revealed measure of relatedness and not a definite measure. Intuitively, some product relationships are direct in nature in the sense that productive capabilities and knowledge are directly transferable. However, for some of these relationships, the relatedness is not that apparent and thus is of a more indirect nature. This is especially the case for some of the input–output relations in the agro-complex where there exists a link between products but not between the production practices (i.e. capabilities an knowledge). The table thus provides an indication of whether the productive relationship is considered direct or indirect. The latter implies that the transfer of capabilities and knowledge needs further assessment in order to capitalise on the diversification opportunity.

A complete overview of South Africa's diversification opportunities per cluster in the agro-complex is shown in Data Supplement IV, which provides a ranking the 60 opportunities originating from the country's core competencies, and Data Supplement V provides a ranking the 217 opportunities stemming from its general productive structure. Of the 60 opportunities linked to South Africa's core competencies, 18 are already produced at a relatively low level of specialisation and are marked in bold in Data Supplement IV. In cases of high *opportunity values*, building stronger linkages with these specific products will further enhance their development. It can be seen that the 217 diversification opportunities originating from the country's overall productive structure consist solely of products which are not currently produced by South Africa.

Table 6.3: South Africa's top 10 diversification opportunities for structural transformation from the core competencies in the agro-complex

Diversification opportunities						← Core competency			
#	HS	Product	Cluster *	Opp. value	Strategic value	HS	Product	Cluster *	Productive relationship
1	470421	Chemical wood pulp, sulphite, other than dissolving grades, semi-bleached/b ...	FO	1.18	Yes	470200	Chemical wood pulp, dissolving grades	FO	direct
2	430160	Raw furskins, of fox, whole, with/without head/tail/paws	AN	1.01	Yes	430110	Raw furskins, of mink, whole, with/without head/tail/paws	AN	direct
3	450110	Natural cork, raw/simply prepd.	FO	0.85	Yes	450200	Natural cork, debacked/roughly squared/in rect. (incl. square) blocks/plate	FO	direct
4	320300	Colouring matter of veg./animal origin (incl. dyeing extracts. excl. animal	AN	0.67	Yes	220870	Liqueurs & cordials	AF	indirect
5	310240	Mixtures of ammonium nitrate with calcium carbonate/oth. inorganic non-fert	AI	0.56	Yes	310260	Double salts & mixts. of calcium nitrate & ammonium nitrate	AI	direct
6	200110	Cucumbers & gherkins, prepd./presvd. by vinegar/acetic acid	AF	0.55	Yes	200190	Vegetables, fruit, nuts & oth. edible parts of plants (excl. cucumbers & gh	AF	direct
7	**20734**	**Fatty livers of ducks/geese/guinea fowls, fresh/chilled**	**AF**	**0.54**	**Yes**	20736	Meat & edible meat offal of ducks/geese/guinea fowls	AF	direct
8	**81190**	**Fruit & nuts, n.e.s., uncooked/cooked by steaming/boiling in water, frozen, ...**	**AF**	**0.44**	**Yes**	200190	Vegetables, fruit, nuts & oth. edible parts of plants (excl. cucumbers & gh	AF	direct
9	**210420**	**Homogenised composite food preps.**	**AF**	**0.43**	**Yes**	190420	Prepared foods obt. from unroasted cereal flakes/mixts. of unroasted cer.	AF	direct
						200892	Mixtures of edible parts of plants, prepd./presvd.,	AF	direct
10	470421	Chemical wood pulp, sulphite, other than dissolving grades, semi-bleached/b ...	FO	1.18	Yes	470200	Chemical wood pulp, dissolving grades	FO	direct

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs

Source: Author's own calculations (2013)

Table 6.4: South Africa's top 10 diversification opportunities for structural transformation from the overall productive structure in the agro-complex

Diversification opportunities						← Production			
#	HS	Product	Cluster *	Opp. value	Strategic value	HS	Product	Cluster *	Productive relationship
1	020733	Meat of ducks/geese/guinea fowls, not cut in pieces, frozen	AF	1.28	Yes	20110	Carcasses/half-carcasses of bovine animals, fresh/chilled	AF	direct
2	843510	Presses, crushers & sim. mach. used in the mfr. of wine/cider/fruit juices/	AI	1.27	Yes	220410	Sparkling wine of fresh grapes	AF	indirect
3	470691	Pulps of fibres derived from recovered (waste & scrap) paper/paperboard/	FO	1.27	Yes	480240	Wallpaper base	FO	direct
4	481039	Kraft paper & paperboard other than that of a kind used for writing/printing	FO	1.23	Yes	21099	Meat & edible meat offal, n.e.s., salted/in brine/dried/smoked, incl. edibl	AF	direct
5	470421	Chemical wood pulp, sulphite, other than dissolving grades, semi-bleached/	FO	1.18	Yes	470200	Chemical wood pulp, dissolving grades	4	direct
6	310240	Mixtures of ammonium nitrate with calcium carbonate/oth. inorganic non-fert.	AI	1.13	Yes	310260	Double salts & mixts. of calcium nitrate & ammonium nitrate	AI	direct
						310280	Mixtures of urea & ammonium nitrate in aqueous/ammoniacal solution	AI	direct
7	030561	Herrings (Clupea harengus/pallasii), salted (but not dried/smoked)/in brine	AF	1.09	Yes	30350	Herrings (Clupea harengus/pallasii), frozen	AF	direct
8	030263	Coalfish (Pollachius virens), fresh/chilled (excl. fillets/oth. fish meat	AF	1.08	Yes	30221	Halibut (Reinhardtius hippoglossoides, Hippoglossus hippoglossus/stenolepis	AF	direct
						30222	Plaice (Pleuronectes platessa), fresh/chilled (excl. fillets/oth. fish meat	AF	direct
						30262	Haddock (Melanogrammus aeglefinus), fresh/chilled (excl. fillets/oth. fish	AF	direct
9	430160	Raw furskins, of fox, whole, with/without head/tail/paws	AN	1.01	Yes	430110	Raw furskins, of mink, whole, with/without head/tail/paws	AN	direct

(Table 6.4 continued)

10	020732	Meat of ducks/geese/guinea fowls, not cut in pieces, fresh/chilled	AF	1.01	Yes	200310	Mushrooms of the genus Agaricus, prepd./presvd. othw. than by vinegar/aceti	AF	indirect
						20735	Meat & edible meat offal of ducks/geese/guinea fowls	AF	direct
						20736	Meat & edible meat offal of ducks/geese/guinea fowls , bone-in	AF	direct

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs

Source: Author's own calculations (2013)

A summary of the diversification opportunities stemming from the core competencies in the agro-complex is provided in Table 6.5. It is evident that by far the most opportunities exist within the agro-processing of food cluster. Table 6.5 also indicates the average number of diversification pathways per cluster, which is an indication of the average number of links with the core competencies per opportunity. This reveals that the diversification opportunities within primary agriculture have the strongest links with existing production. Table 6.5 furthermore shows that forestry has the largest share of direct productive relationships between its existing production and the identified opportunities for diversification. The number of indirect productive relationships is the largest for the opportunities within primary agriculture. The last column indicates the proportion of diversification opportunities which have a positive strategic value for upgrading South Africa's level of complexity within the agro-complex. Table 6.5 shows that all of the opportunities within the agricultural input cluster have a positive strategic value, whereas only 65 per cent of the opportunities within agro-processing of food have a higher level of complexity than the cluster average.

Table 6.5: Summary table of diversification opportunities from South Africa's core competencies in the agro-complex

	Number of opportunities	Share	Average diversification pathways	Direct productive relationship	Positive strategic value
Primary Agriculture	8	13%	1.5	67%	83%
Agro-processing: food	31	51%	1.1	94%	65%
Agro-processing: non-food	9	15%	1.2	82%	91%
Forestry	8	13%	1.0	100%	88%
Agricultural inputs	4	7%	1.0	75%	100%

Source: Author's own calculations (2013)

The opportunities for diversification stemming from the overall productive structure in the agro-complex are summarised in Table 6.6. The total number of opportunities when moving from South Africa's core competencies to its total production in the agro-complex increases

the most for agro-processing of non-food, and the least for primary agriculture. This is not surprising as South Africa already has the highest presence in the agricultural product space with regard to this specific cluster (see also Figure 5.10). It is evident from the table that the most opportunities exist within agro-processing of food. Opportunities in this cluster, as well as forestry, have a strong relationship with existing production, both in terms of the number of linkages, as well as in the nature of productive relationship. The strategic value of the opportunities in most clusters is proportionally high, although primary agriculture lags behind

Table 6.6: Summary table of diversification opportunities from South Africa's overall productive structure in the agro-complex

	Number of opportunities	Share	Average diversification pathways	Direct productive relationship	Positive strategic value
Primary Agriculture	13	6%	1.0	77%	62%
Agro-processing: food	86	40%	1.7	90%	87%
Agro-processing: non-food	72	33%	1.3	94%	92%
Forestry	32	15%	1.7	100%	95%
Agricultural inputs	14	6%	1.4	37%	100%

Source: Author's own calculations (2013)

Given the outcomes presented in the two tables above, diversifying for structural transformation and economic development from South Africa's agro-complex cannot be derived from targeting a single cluster, but requires an inclusive, product-level approach.

Section 5.3.2 has already revealed that some strong input–output relationships exist in the agricultural product space. This implies that, apart from inter-cluster diversification, there is also potential for intra-cluster diversification in the agro-complex. The degree to which this applies to South Africa is shown in Table 6.7. The top part of the table shows the proportion of inter- and intra-cluster diversification pathways for South Africa's core competencies. The first column of the matrix reflects the current production in each cluster, which is thus the

origin of the diversification pathways. The top row of the matrix reflects the diversification opportunities in each cluster and thus the destination of the pathway. It is evident from the top part of the table that most diversification pathways comprise inter-cluster relationships. However, it is evident that there are some important intra-cluster diversification pathways for South Africa. The intra-cluster diversification pathways from agro-processing of food to primary agriculture (33%) and the pathways from primary agriculture to agricultural inputs to (25%) are especially significant.

Table 6.7: Overview of South Africa's inter- and intra-cluster pathways for diversification in the agro-complex

DIVERSIFICATION OPPORTUNITIES FROM SA'S CORE COMPETENCIES						
		Diversification opportunity				
		Primary agriculture	Agro-processing: food	Agro-processing: non-food	Forestry	Agricultural inputs
Production	Primary agriculture	58%	15%	0%	0%	25%
	Agro-processing: food	33%	76%	18%	0%	0%
	Agro-processing: non-food	0%	6%	73%	0%	0%
	Forestry	8%	0%	0%	100%	0%
	Agricultural inputs	0%	3%	9%	0%	75%

DIVERSIFICATION OPPORTUNITIES FROM SA'S TOTAL PRODUCTIVE STRUCTURE						
		Diversification opportunity				
		Primary agriculture	Agro-processing: food	Agro-processing: non-food	Forestry	Agricultural inputs
Production	Primary agriculture	69%	11%	2%	2%	5%
	Agro-processing: food	15%	85%	2%	2%	74%
	Agro-processing: non-food	8%	1%	89%	2%	0%
	Forestry	8%	0%	5%	95%	0%
	Agricultural inputs	0%	3%	1%	0%	21%

Source: Author's own calculations (2013)

The bottom part of Table 6.7 shows the distribution of the inter- and intra-cluster diversification pathways for the country's overall productive structure. Similarly, most diversification pathways are also within the clusters. The proportions of inter-cluster pathways are even higher compared to the top part of the table. The only exception is agricultural inputs, which has a significant share of its diversification pathways originating from the agro-processing of food sector (74%).

The results in the table emphasise the point that diversifying for structural transformation and growth can also build stronger input–output relations in the agro-complex. These types of relationships are important from the perspective of an increase in local value adding and the domestic content of exports, as was evident from the analysis in Chapter three.

6.3.6 Opportunity clusters within South Africa's agro-complex

Figure 6.13 in Section 6.3.5 revealed the existence of some related diversification opportunities. These clusters of diversification opportunities are further explored in this section. The opportunity clusters provide promising perspectives for accelerated diversification in the agro-complex since the high level connectedness eases the transfer of capabilities and knowledge among these products. Furthermore, an opportunity cluster opens up the potential for targeting a bundle of diversification opportunities in one concerted effort.

The Clauset-Newman-Moore clustering algorithm is applied (see Clauset, Newman and Moore, 2004) to the opportunity network to identify community structures among the 217 diversification opportunities. The result is shown in Figure 6.16 which depicts a total of nine opportunity clusters for South Africa in the agro-complex. Opportunity clusters which comprise less than ten products were not included in the figure. South Africa's current productive structure in the opportunity clusters are depicted by solid diamond node shapes. The nodes of its core competencies are marked in red and the nodes of its general productive structure are marked in black. The sizes of the nodes are proportional to the corresponding *opportunity value* of that product. A summary of the nine opportunity clusters is provided in Table 6.8.

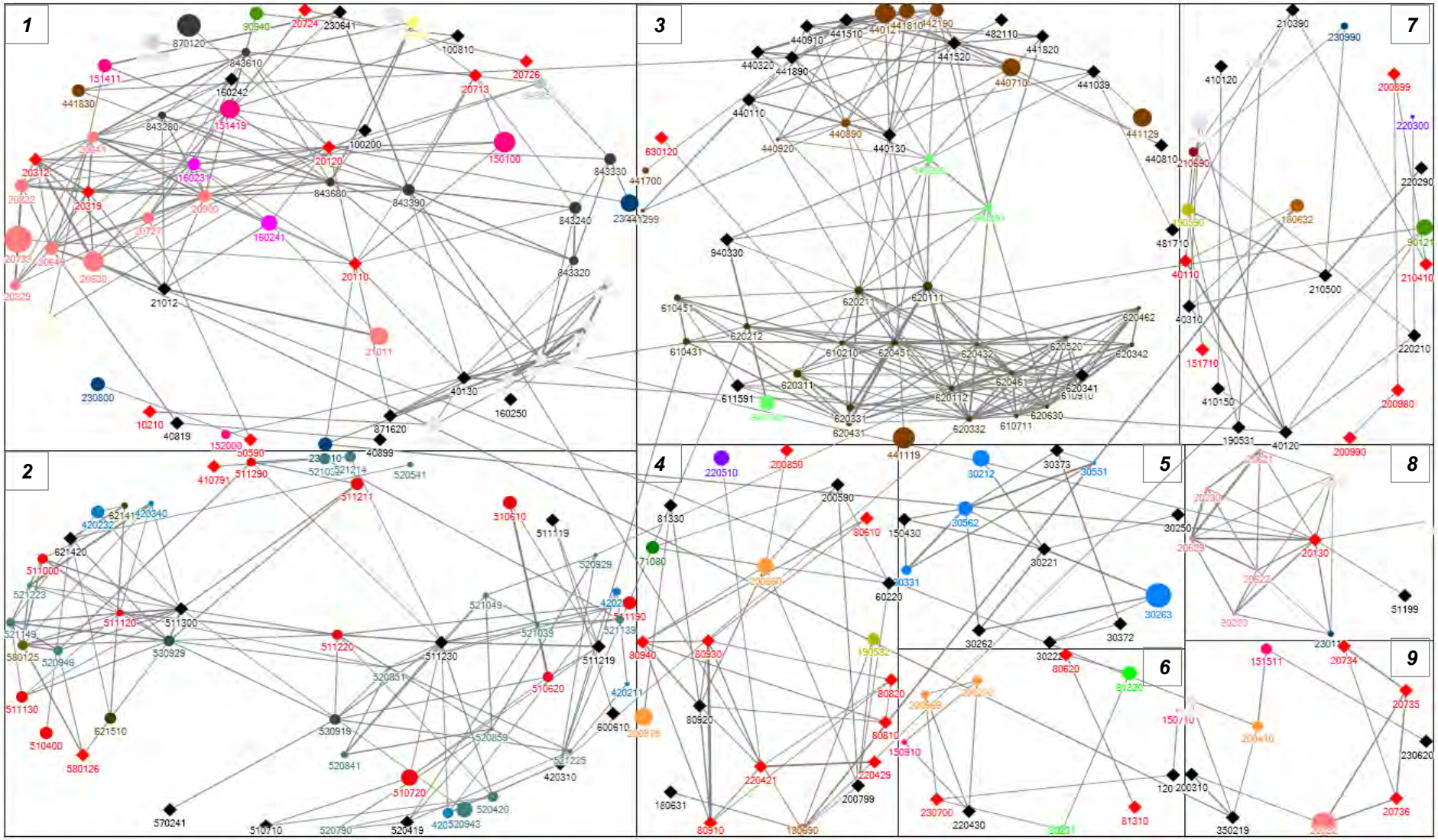


Figure 6.16: Overview of opportunity clusters in South Africa's agro-complex

Source: Author's own calculations (2013)

Table 6.8: Summary of South Africa's opportunity clusters in the agro-complex

	Opportunity cluster	Product groupings	Products			Average number of connections per product	Average opportunity value	Share of opportunities with strategic value	Share of direct productive relationships
			Diversification opportunities	High specialisation in production	Low specialisation in production				
1	**Animal products**	Meat, dairy, agricultural machinery	39	1	18	2.7	0.34	100%	82%
2	**Natural fabrics**	Wool, leather articles, woven fabrics	38	2	10	2.3	0.14	100%	100%
3	**Wood and textiles**	Wood products, paper products, textiles of natural fibres	33	1	15	4.3	0.15	97%	93%
4	**Fruits**	Fruit, wine, processed fruit, cacao products	6	9	6	1.7	0.36	100%	100%
5	**Fish products**	Fish, fish oils	5	0	7	1.5	0.41	100%	100%
6	**Processed fruits and vegetables**	Juice, oil, dried fruit	6	3	2	1.1	0.08	83%	75%
7	**Food preparations**	Beverages, bakery products, dairy products	8	6	9	1.2	0.16	88%	100%
8	**Meat products**	Meat, processed meat	8	0	2	2.3	-0.06	38%	100%
9	**Poultry and prepared food products**	Poultry meat, prepared egg and vegetables	4	1	5	1.2	0.39	100%	60%

Source: Author's own calculations (2013)

The nine opportunity clusters in Table 6.8 include 67 per cent of the total of 217 diversification opportunities identified for South Africa. It is evident from the table that, apart from the opportunity cluster for fruit, the numbers of core competencies (i.e. high level of specialisation in production) are relatively limited; this is, however, balanced by a significant number of existing products with a lower level of specialisation. The nine clusters are ranked according to their potential contribution to upgrading South Africa's agro-complex. Hence, this prioritisation of clusters provides guidance for targeting a bundle of diversification opportunities, rather than focusing on individual products.

It is evident from Table 6.8 that only clusters one to three (animal products, natural fabrics, wood and textiles) include a relatively large number of diversification opportunities. Opportunity cluster one (animal products) has a relatively high degree of connectedness, as reflected by the average number of linkages per product. It furthermore solely includes diversification opportunities with a positive strategic value. Opportunity cluster two predominantly consists of products of natural fibres. All of the diversification opportunities in this specific cluster have a positive strategic value, as well as direct productive linkages with existing production. The third opportunity clusters entail both products of wood and textiles. These product groups are not directly related and thus form two sub-clusters within a large cluster (see also panel three in Figure 6.16). The connectedness within these sub-clusters is very strong, as is evident from the high average number of connections per product. Almost all diversification opportunities in this cluster have a positive strategic value and a direct productive connection with existing production.

6.3.7 Opportunity outlook in South Africa's agro-complex

The *opportunity value* as used in Section 6.3.5 can be interpreted as the short-term prospects of upgrading to a nearby product that is already connected to a country's productive structure; the so-called "first-round" diversification. However, this measure does not reveal any information on the potential for structural transformation from subsequent diversification moves in the agricultural product space. Therefore, the long-term strategic value for upgrading a country's productive structure can be measured by a measure called *opportunity outlook* (see Section 4.3.4). This measure quantifies the proximity of each

diversification opportunity to more complex products which are not currently connected to a country's productive structure in the product space. Hence, it indicates the prospects for "second-round" diversification opportunities. The higher the value of the *opportunity outlook*, the more the potential exists for a country's long-term structural transformation.

Figure 6.17 shows the O*pportunity outlook* for South Africa in the agro-complex. It is evident that diversification within the agro-processing of food and the agricultural input clusters has the most potential for long-term structural transformation. Comparing the outcomes presented Figure 6.17 with those in Figure 6.14 in Section 6.3.5, the notion arises that the level of the *Opportunity value* and the level of O*pportunity outlook* seem to be related. Hence, short-term gains from upgrading does likely imply long-term perspectives for structural transformation in the agro-complex. However, the great exception here is the agro-processing of non-food cluster.

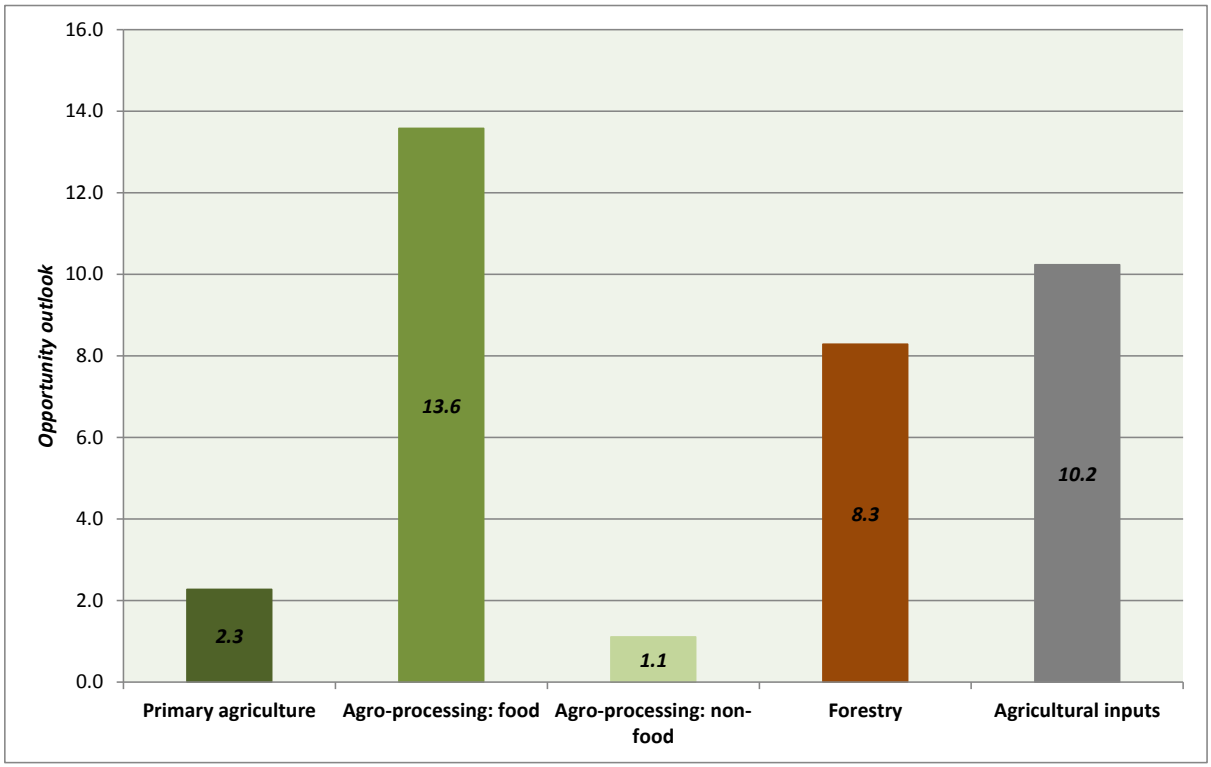


Figure 6.17: Opportunity outlook for South Africa's agro-complex
Source: Author's own calculations (2013)

Of the total of 217 diversification opportunities, 45 per cent have no-long term strategic value (i.e. an *opportunity outlook* of equal to zero). This implies that they are "death avenues" for structural transformation as they have no further connections in the agricultural product space. A further 13 per cent of South Arica's diversification opportunities have a negative *opportunity outlook*. These are "downhill avenues" for diversification, as they hold little or no future potential for upgrading the country's agro-complex. A total of 42 per cent of the diversification opportunities embed a positive long-term prospect for structural transformation. The top and bottom ten diversification opportunities in terms of long-term strategic value are shown in Table 6.9.

Table 6.9: Overview of the products with most and least long-term strategic value

Top 10 products			
HS code	**Product**	**Cluster ***	***Opportunity outlook***
620432	Women's/girls' jackets & blazers (excl. knitted or crocheted), of cotton	AN	4.23
620332	Men's/boys' jackets & blazers (excl. knitted or crocheted), of cotton	AN	3.85
843280	Agricultural/horticultural/forestry mach. for soil preparation/cultivation ...	AI	3.12
120510	Low erucic acid rape/colza seeds, whether or not broken	PA	2.99
610910	T-shirts, singlets & oth. vests, knitted or crocheted, of cotton	AN	2.97
620520	Men's/boys' shirts (excl. knitted or crocheted), of cotton	AN	2.92
610431	Women's/girls' jackets & blazers, knitted or crocheted, of wool/fine ani	AN	2.73
620461	Women's/girls', trousers, bib & brace overalls, breeches & shorts (excl.	AN	2.53
40410	Whey & modified whey, whether or not concentrated/sweetened	AF	2.50
480258	Paper & paperboard, not cont. fibres obt. by a mech./chemi-mech. process/of ...	FO	2.45
Bottom 10 products			
HS code	**Product**	**Cluster ***	***Opportunity outlook***
521039	Woven fabrics of cotton (excl. of 5210.31 & 5210.32), cont. <85% by wt. of ...	AN	-8.49
620630	Women's/girls' blouses, shirts & shirt-blouses (excl. knitted or crocheted) ...	AN	-5.39
520929	Woven fabrics of cotton (excl. of 5209.21 & 5209.22), cont. 85%/more	AN	-5.30
520841	Woven fabrics of cotton, cont. 85%/more by wt. of cotton, of yarns of diff.	AN	-3.33
151190	Palm oil, other than crude, & fractions thereof , whether or not ref.	AF	-2.91
520949	Woven fabrics of cotton (excl. of 5209.41-5209.43), cont. 85%/more by	AN	-2.82
610452	Women's/girls' skirts & divided skirts, knitted or crocheted, of cotton	AN	-2.75
521139	Woven fabrics of cotton (excl. of 5211.31 & 5211.32), cont. <85% by w	AN	-2.70
530919	Woven fabrics of flax (excl. of 5309.11), cont. 85%/more by wt. of flax	AN	-2.56
520859	Woven fabrics of cotton (excl. of 5208.51-5208.43), cont. 85%/more by	AN	-2.52

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs.

Source: Author's own calculations (2013)

A complete overview of the long-term strategic value of the diversification opportunities can be found in Data Supplement VI.

This section investigated the potential for structural transformation in South Africa's agro-complex as where the next section will identify the diversification opportunities based on market potential.

6.4 MARKET-DRIVEN DIVERSIFICATION

6.4.1 Introduction

Apart from structural transformation, another important strategic value for diversification and growth is economic contribution. Diversifying to more complex products and accumulation of new productive capabilities without gains in earnings from production is unsustainable and futile. Hence, profit generation by firms from producing "new" products can only take place if there is sufficient market demand for that product, either locally or abroad. This section takes its point of departure from the outcomes of the analyses in chapter three which identified four market-driven channels through which South Africa could diversify its agro-complex (see Section 3.10). The methodological framework of analysing the product-level opportunities of these four channels within the framework of the agricultural product space was presented in Section 4.4.

Before investigating the diversification opportunities within the four channels, the first three parts of this section discus the global demand for the products in the agricultural product space, the results of the Decision Support Model (see also Section 4.4.2), and the domestic content of the country's exports in the agro-complex.

6.4.2 Global demand in the agricultural product space

Global demand for products can be proxied by their respective sizes of international trade. Hence, products with larger trade flows are higher in demand, globally. The initial model of the agricultural product space as depicted in Figure 5.4 of Section 5.2.2 already indicates the distribution of global demand in the network, as reflected by the proportional sizes of the nodes. Figure 6.18 elaborates on this by inflating the proportional node sizes according to the product's share in global agricultural trade. Figure 6.4 in Section 6.3.3 has already shown that the products included in the agricultural product space specified for this study[42] represent 69 per cent of global agricultural trade. Figure 6.18 shows that some of the products with a large global demand include tractors, wheat, food preparations n.e.s., men's cotton underpants, wooden furniture, soya beans, wooden planks, coffee, palm oil and wine.

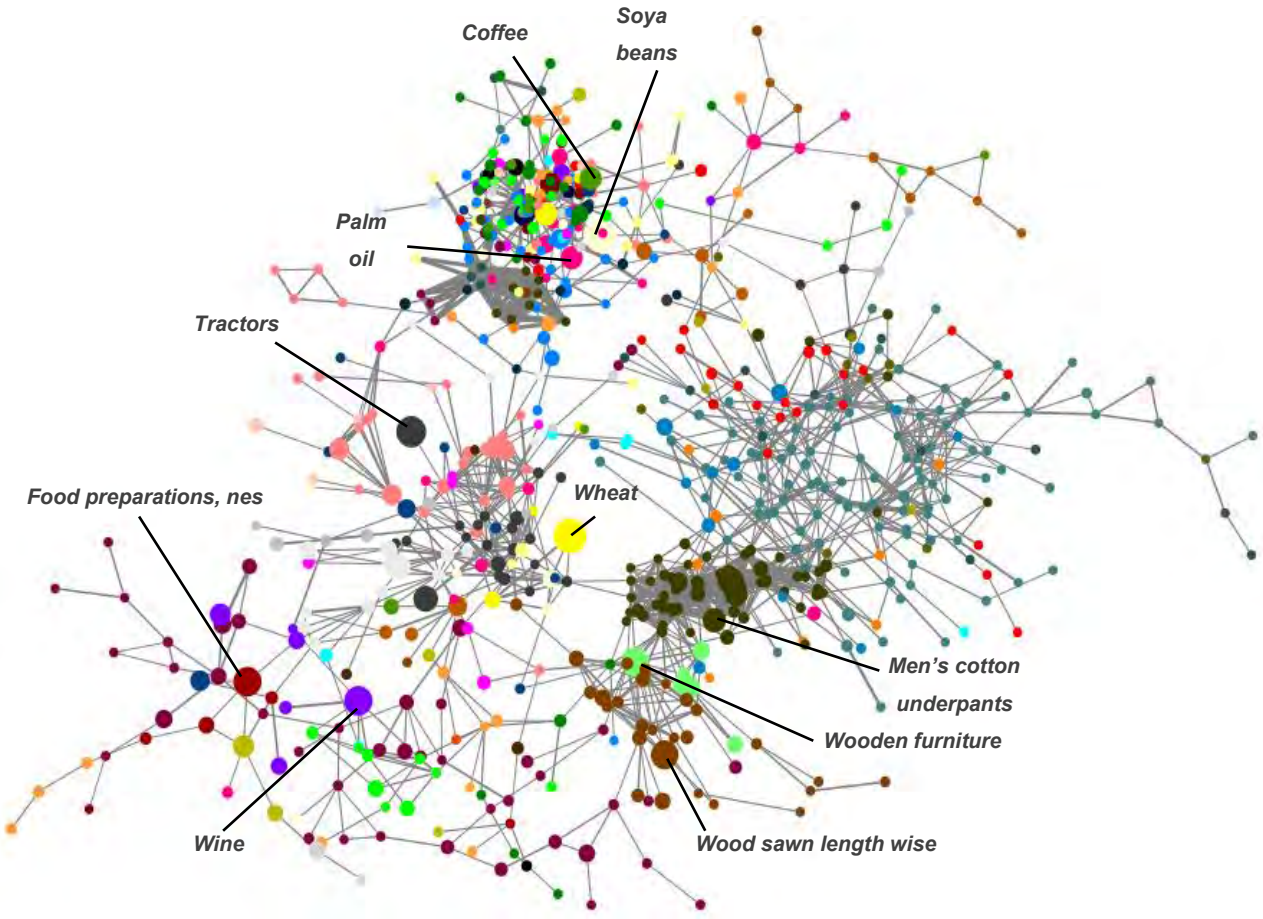


Figure 6.18: Global demand in the agricultural product space
Source: Author's own calculations (2013)

[42] Only products with a significant level of relatedness, reflected by a proximity of >0.55, are included in the agricultural product space specified in this study.

From Figure 6.18 it is evident that the products with a relatively large global demand are scattered over the denser and sparser parts of the network. Further analysis of the relationship between the location in the agricultural product space (i.e. proxied by the measure of *Centrality*) and the level of global demand reveals a weak statistical relationship. The Parson's correlation coefficients amounts to 0.08 and is significant at the 0.05 level. Hence, if the global demand for a product increases, its location in the network is slightly more connected and central. This implies that, in general, the diversification to products in the product space which are higher in demand should be somewhat easier. However, the prospect of diversification pathways is strongly determined by a country's current position in the network.

The relationship between product complexity and global demand is explored in Figure 6.19. From the positive slope of the fit line, it seems that the more complex products are higher in demand globally. However, statistical analysis shows an insignificant relationship. Structural transformation (i.e. the upgrading to more complex products) is not a straightforward process, considering that global market potential is also an important determinant for sustainable diversification ventures.

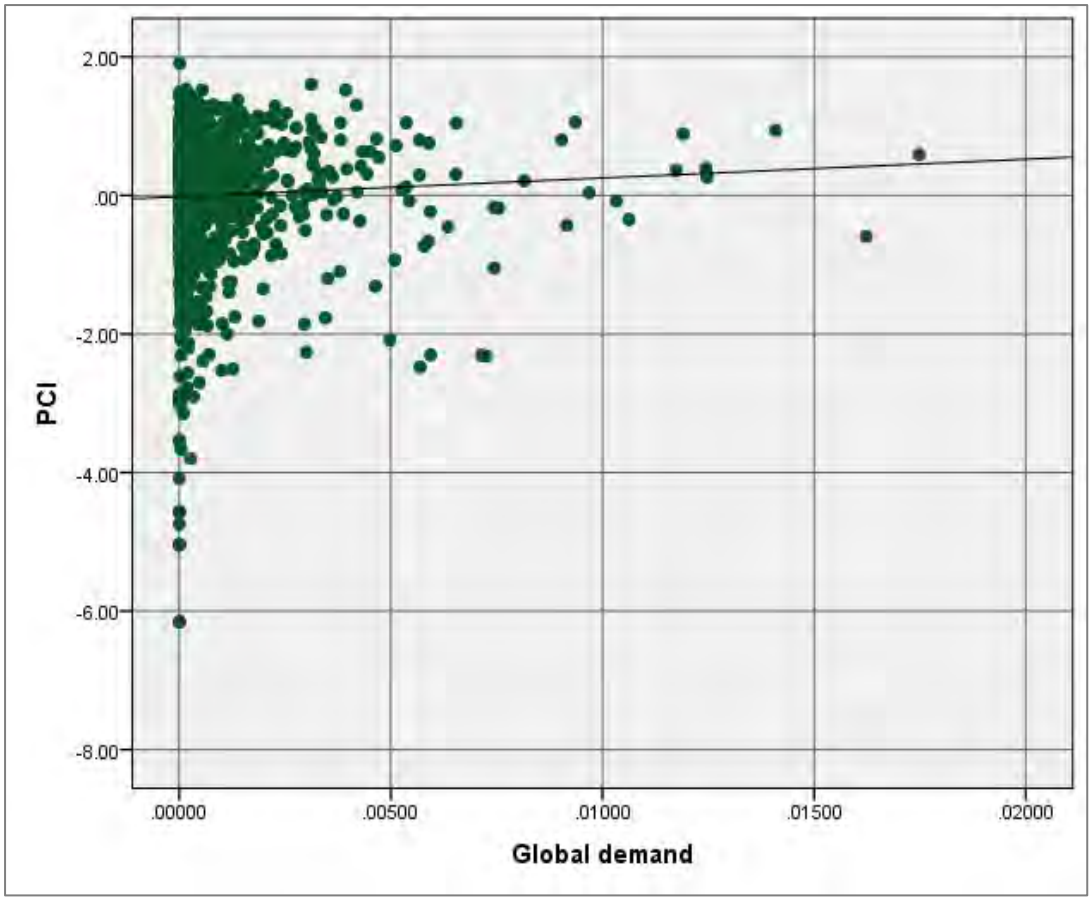


Figure 6.19: Complexity and global demand in the agro-complex
Source: Author's own calculations (2013)

6.4.2 Results of the Decision Support Model for South Africa's agro-complex

The Decision Support Model (DSM), as described in Section 4.4.2, is a powerful tool for identifying realistic export opportunities (e.g. product country combinations). This sub-section will present some general and stylised facts on the results of the model, specifically for the agricultural product space. A more in-depth discussion of the implications of these results for South Africa's diversification pathways will follow in later sub-sections. Figure 6.20 A-E provides an overview of South Africa's export opportunities in the agro-complex.

Figure 6.20 makes a distinction between the potential export values for products already produced (solid bubbles) and the products not currently produced (circles) in each of the five clusters. Furthermore, the figure shows the average level of complexity (y-axis), as well as the average number of potential export markets (x-axis) per group.

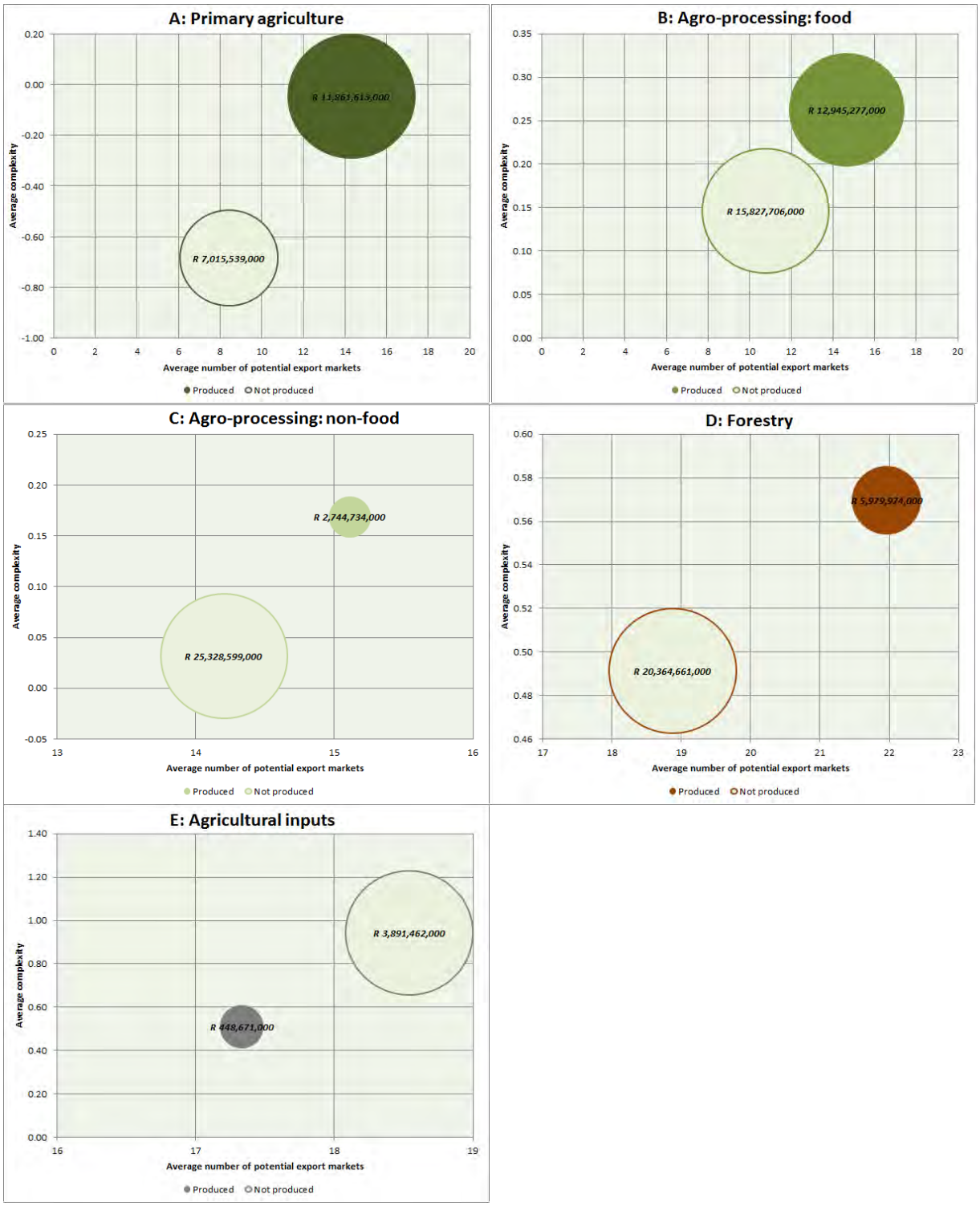


Figure 6.20 (A-E): South Africa's realistic export opportunities in the agricultural product space

Source: Author's own calculations (2013) based on data from Steenkamp (2011)

Figure 6.20 shows that, apart from the primary agricultural cluster, most of South Africa's export potential in the agro-complex is concentrated in "new" products. However, the level of complexity and number of potential export markets is on average lower, except for those "new" products within the agricultural input cluster. Furthermore, South Africa's potential for market diversification of existing products is less favourable, compared to the income gains that can be expected from exporting "new" products. The relative positions of these in relation to South Africa's current productive structure in the agricultural product space will determine the actual feasibility of unlocking their export potential. This will, however be explored in more detail in Section 6.4.7.

Figure 6.21 below groups the export opportunities according to cluster and geographical distribution. Most realistic export opportunities exist in the agro-processing of non-food cluster, followed by agro-processing of food. Furthermore, the figure shows that the most realistic export opportunities for South Africa's agro-complex are prevalent in the EU 15[43]. This region has the most opportunities in all five clusters. Central and Eastern Europe (CEEC) and the Middle-East are two other important regions with favourable prospects for exports. These two regions have the most scope for market diversification, seeing that the EU 15 has been a traditional export destination for decades.

On the other hand, a few realistic export opportunities exist in Central America and the Caribbean, Oceania, and Northern Europe (non-EU). These regions have, however, a relatively small population size. Furthermore, South Africa's regional market, Africa, is ranked sixth out of the thirteen regions. It is remarkable from the figure that the number of realistic export opportunities in the Asian growth markets is relatively few.

[43] This relative high concentration of export opportunities in the EU may be attributed to the "Rotterdam effect" which entails the double counting of re-exports by the point-of-entry as well as the "secondary" importer. This may result in the inflation of demand in the EU within the DSM framework. Data limitations on re-exports constrain this issue.

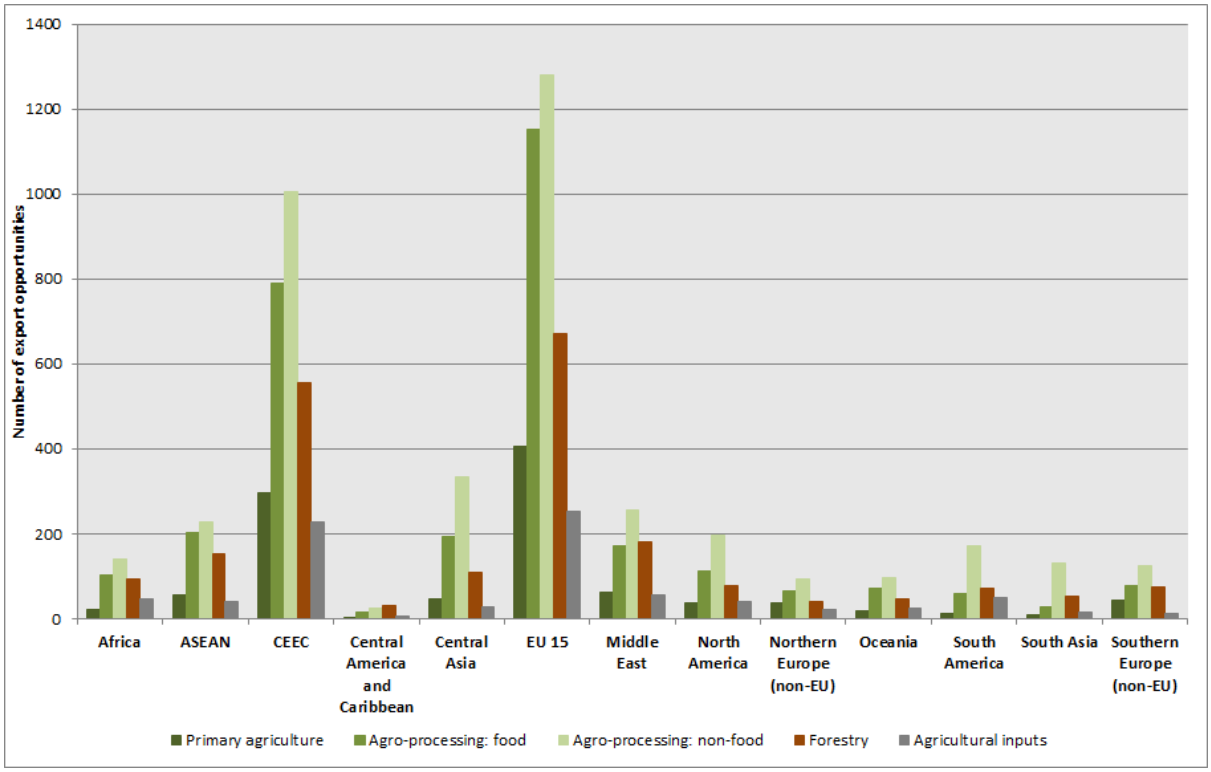


Figure 6.21: Geographical distribution of South Africa's realistic export opportunities in the agro-complex

Source: Author's own calculations (2014) based on data from Steenkamp (2011)

The categorisation of the DSM was discussed in Table 4.1 in Section 4.4.2. This categorisation provides guidance in terms of the appropriate export promotion strategy. A total of 11 155 realistic export opportunities (product–country combinations) for South Africa's agro-complex are categorised in Table 6.10. This table shows that for a significant majority (90 per cent) of the export opportunities, South Africa has no, or a relatively small, market share. Furthermore, most (59 per cent) of the realistic export opportunities in the agro-complex are located in markets with both short- and long-term growth. However, as the table shows, these specific opportunities are in the smaller product markets. About 12 per cent of the realistic export opportunities are in large product markets which do not show much growth, and a further nine per cent of opportunities are located in large product markets with both short- and long-term growth. Based on the categorisation in Table 6.10, Cuyvers *et al.* (1995) suggest an offensive market exploration strategy for the export promotion of the majority (93 per cent) of South Africa's export opportunities in the agro-complex.

Table 6.10: Categorisation matrix of South Africa's realistic export opportunities in the agro-complex

Size and growth of importing market	Market share of South Africa				
	None or relatively small	Intermediately small	Intermediately small	Relatively high	*Total*
Large product market	1 364 (12%)	135 (1%)	118 (1%)	63 (1%)	*1 680 (15%)*
Growing (short- and long term) product market	6 572 (59%)	50 (0.4%)	61 (1%)	189 (2%)	*6 872 (62%)*
Large product market with short-term growth	634 (6%)	73 (1%)	57 (0.3%)	31 (0.3%)	*795 (7%)*
Large product market with long-term growth	408 (4%)	25 (0.2%)	30 (0.3%)	23 (0.2%)	*486 (4%)*
Large product markets with short- and long term growth	1 051 (9%)	105 (1%)	106 (1%)	60 (1%)	*1 322 (12%)*
Total	*10 029 (90%)*	*388 (3%)*	*372 (3%)*	*366 (3%)*	

Source: Author's own calculations (2014) based on data from Steenkamp (2011)

6.4.3 The domestic content of South Africa's agro-complex

The analysis in Chapter three has already revealed that South Africa's agro-complex is relatively diversified and that most export growth has come from the intensive margin, namely by exporting existing products to existing markets (see Sections 3.6 and 3.8). However, chapter three also revealed that a large proportion of the country's export products in the agro-complex have a negative trade balance (sees Section 3.6.2). Hence, this section further investigates the spectrum of traded products and the extent of their local content.

Figure 6.22 below illustrates the proportionate numbers of products in the agro-complex which are traded by South Africa. To eliminate insignificant trade flows, only products with a traded value of more than 10 000 USD are included. The figure confirms that South Africa's trade is relatively diversified. Only the number of products exported within the agro-

processing of non-food cluster is comparatively small. In terms of exports, the country trades a significant 96.2 per cent of agricultural inputs, which corresponds to 75 of the total 78 products in that cluster. Furthermore, the variety of agro-processed food products exported is also significantly high, with a total of 458 out of 522 products exported. In terms of imports, agricultural inputs also show the most variety (73 out of 78 products), followed by forestry (196 out of 222 products), and agro-processing of food (422 out of 522 products). The primary agricultural cluster shows the least variety in import products. Overall, the variety of exports in the agro-complex is slightly lower than the variety of imported products.

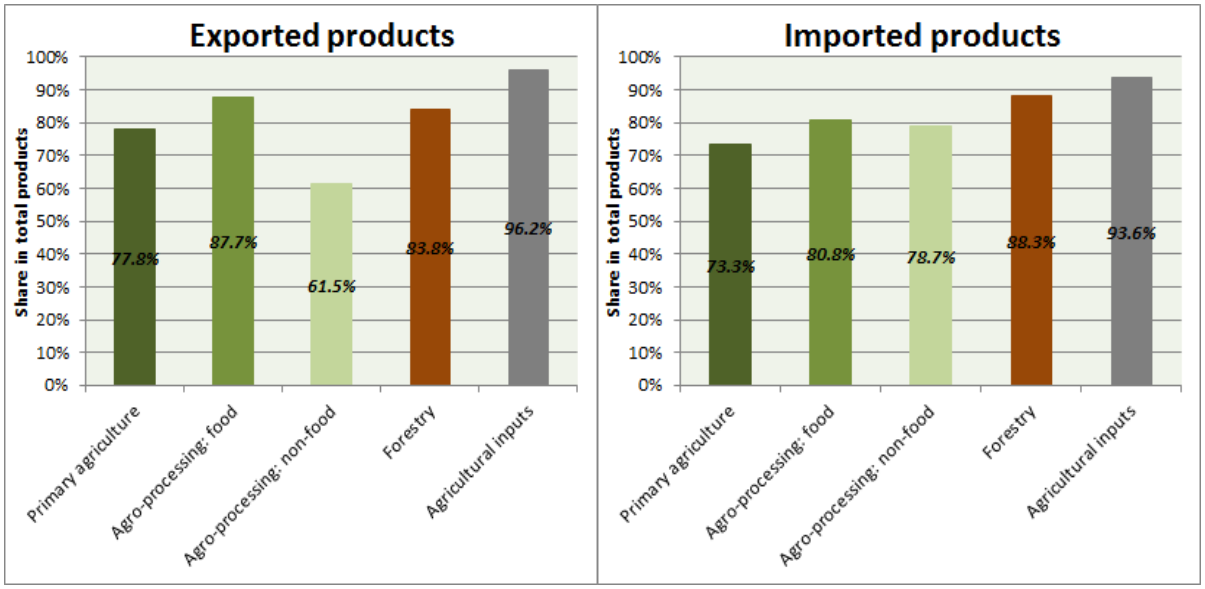


Figure 6.22: Proportion of total products traded in the agro-complex (2009 – 2011)
Source: Author's own calculations (2014)

Figure 6.22 shows the large variety of export products. However, this is only a perspective of trade diversification and does not reveal to what degree this variety is locally produced. The latter is much more important for economic development as it embeds the capabilities and knowledge of a country's productive structure. These core competencies are further explored in the bubble graph in Figure 6.23. This figure shows the characterisation of the country's core competencies in terms of their share in global trade (y-axis), and their share in exports (x-axis) of each cluster, as well as the proportion they represent in the total product spectrum of each cluster (size of the bubble). The share in global trade is a good

indicator of the extent to which the country focuses its production on what the world demands. It is evident from the figure that the core competencies that South Africa has developed in primary agriculture have the largest share in global trade and that the core competencies in agro-processing of food have the smallest share in global trade. Hence, the development of additional core competencies, especially in the agro-processing of non-food, agricultural inputs, agro-processing of food and forestry clusters, will have to lead to a higher market share in the global agro-complex. Hence, in a more dynamic perspective, Section 3.5.6 showed that the orientation of South Africa's agro-complex towards growing global product markets is relatively weak.

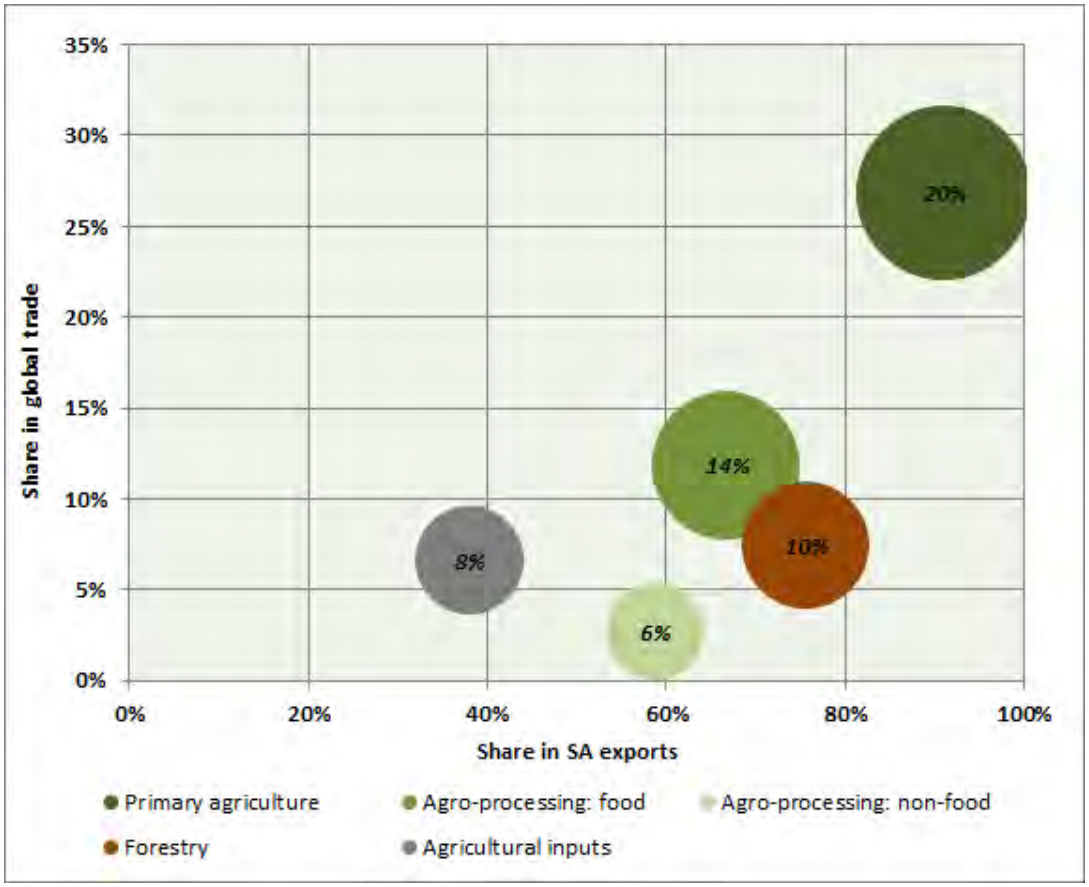


Figure 6.23: Characteristics of South Africa's core competencies in the agro-complex
Source: Author's own calculations (2014)

Figure 6.23 furthermore shows the share of the core competencies in South Africa's exports. Rationally, these shares should be relatively high. This is indeed the case for primary agriculture and the forestry clusters, with respective shares of 91 and 79 per cent. Hence,

most exports in these clusters originate from core competencies and are thus locally produced and competitive on an international level. The 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, respectively. This implies that a relatively large share of the export products in these clusters is not locally produced and not competitive on an international level. This situation can be enhanced by either increasing exports of the core competencies or by developing new core competencies in these specific clusters.

As mentioned, the size of the bubbles in Figure 6.23 represents the proportional share of the country's competencies in the total product spectrum of each cluster. It is evident that the core competencies in primary agriculture are relatively the most expanded, as they represent 20 per cent of the total product spectrum (e.g. 44 out of a total 221 products). The other four clusters are lagging behind in this regard, which therefore shows the most potential for expanding their product range.

Figure 6.24 below shows the characteristics of South Africa's imports in the five clusters of the agro-complex. The x-axis shows the proportion of total import value per cluster in which the country has a comparative import specialisation. This reflects the products for which the country has a relatively large share in total imports, relative to global imports, which is measured by the RMA index (see also Section 3.5.3). The y-axis indicates the share of products with a comparative import specialisation, relative to the total product spectrum of the respective cluster. The proportional size of each bubble represents the total value of imports in 1 000 USD.

It is evident from the figure that South Africa has a significant import specialisation in agro-processing of food. This specific cluster also has the highest level of imports and its variety of import products is relatively low. Hence, there exists some scope for import substitution within this cluster, although the product spectrum is relatively concentrated. The figure also shows that the agricultural input cluster has a comparative import specialisation in a large variety of products which represent a relatively small share of imports in that specific cluster. Hence, the scope for import substitution is large from a product perspective, but relatively small from a value point of view. The three other clusters have relatively low

proportional levels of import specialisation in relation to their total imports. Furthermore, their import specialisation is concentrated on a comparatively small variety of products. Hence, the scope of import substitution within these specific clusters is more limited.

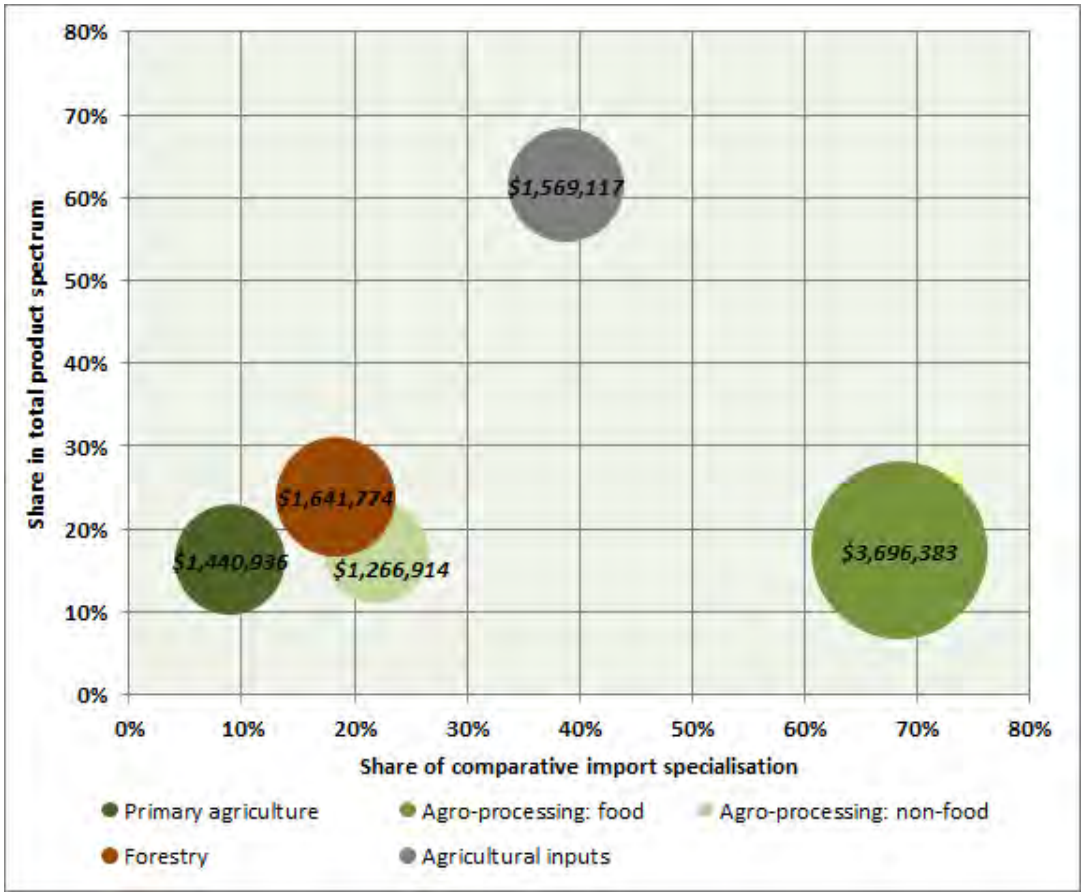


Figure 6.24: Characteristics of South Africa's imports in the agro-complex
Source: Author's own calculations (2013)

Section 3.6.2 has already indicated that a large variety of export products are re-exports. Figure 6.25 below elaborates on this by providing an indication of re-exports within each of the five clusters of the agro-complex. Export products with a negative trade balance are considered as such, since their export supply is predominantly dependent on imports, rather than on local production. In some instances of processing, intra-industry trade (i.e. international trade and value adding within a specific product classification) may account for some re-exports, but it is assumed that this is limited within the context of the agro-complex. The size of the bubbles in figure 6.25 is proportional to the total export value in 1 000 USD.

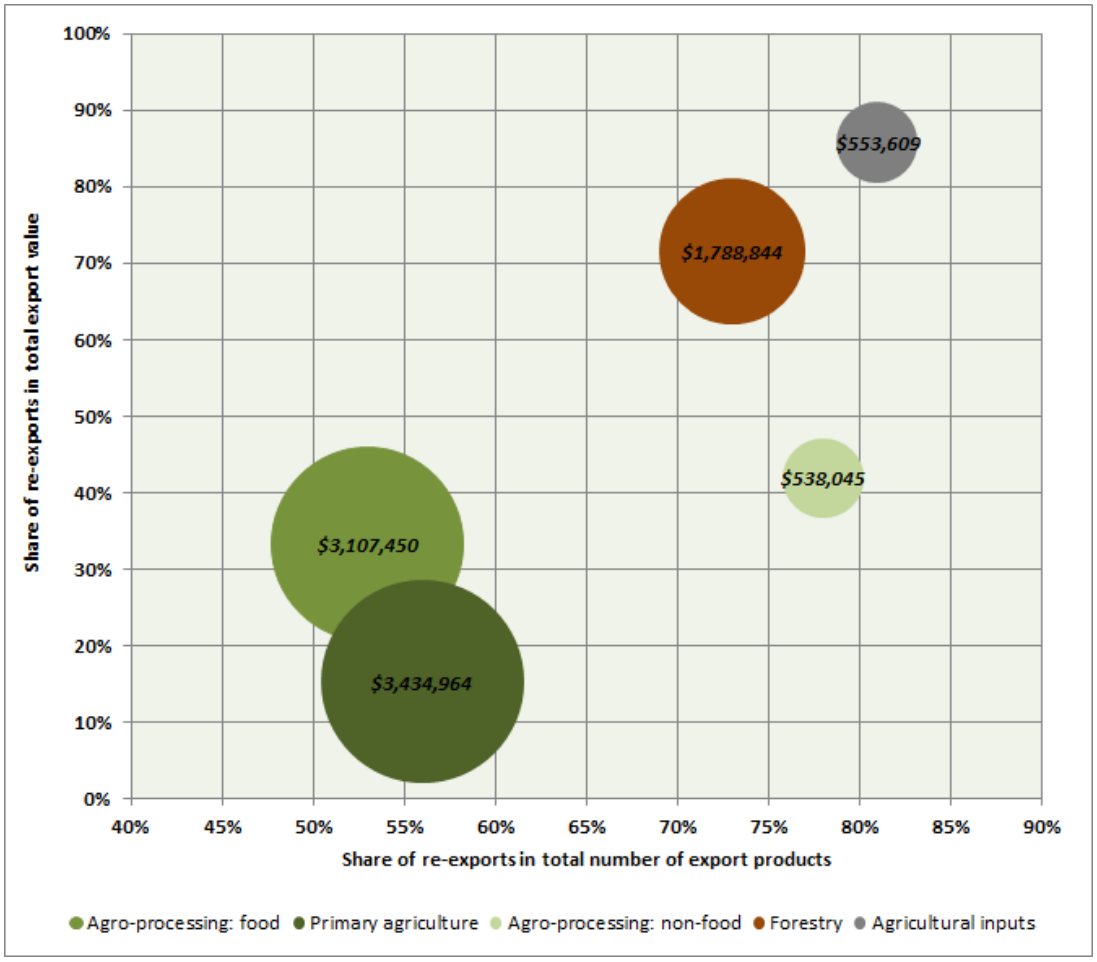


Figure 6.25: Re-exports in South Africa's agro-complex

Source: Author's own calculations (2013)

The figure clearly indicates that for agricultural inputs and forestry clusters, the variety (x-axis) and value (y-axis) of re-exported products are significantly higher than in the other clusters. Although still more than half of the export products within primary agriculture consist of re-exports, the figure shows that this cluster has the lowest value of re-exports in the agro-complex (i.e. 12 per cent).

The agro-processing of food cluster has the second largest contribution to the total export value of the agro-complex. The figure shows that its re-exports account for 33 per cent of its total export value, which is relatively low. The variety of products within this cluster that are re-exported is also relatively low. Hence, re-exports within this specific cluster are more concentrated on fewer products. The forestry cluster is the third largest contributor to total exports in the agro-complex. This specific cluster has a relatively large product variety of re-

exports, at 73 per cent of all its export products. Furthermore, these re-exports constitute a substantial 71 per cent of the cluster's total export value.

The fourth largest contributor to total exports of the agro-complex is the agricultural inputs cluster. Re-exports of agricultural inputs have both a significant share in the total product variety (81 per cent) and the total export value (86 per cent). Hence, South Africa can be regarded a regional trade hub for these specific products. The smallest contributor to total exports is the agro-processing of non-food cluster. This specific cluster also has a large variety of products which are re-exported (78 per cent) and these products make up 43 per cent of total exports within the cluster.

Combining all five clusters, 36 per cent of the total exports value in the agro-complex consists of re-exports. This relatively large proportion can possibly be attributed to the fact that the country has more adequate port and distribution facilities, compared to its coastal neighbours (Namibia and Mozambique). Furthermore, the regional export markets have a relatively large market size combined with favourable economic growth. South Africa's regional export markets, such as Botswana, Zimbabwe, Namibia, Mozambique, Lesotho, Zambia, Uganda, Kenya, Tanzania, Malawi, DRC, Angola, and Swaziland (see also Figure 3.27), have a combined population which is almost six times larger than that of South Africa (World Bank, 2014a).

However, the relatively large proportion of re-exports, and thus limited domestic content, in some clusters is cumbersome from an economic development perspective. Although some local value adding is taking place in case of re-exports, mainly in distribution, the bulk of value adding activities and employment is taking place outside South Africa.

6.4.4 Substitution of re-exports by local production

Section 6.4.3 showed that the proportion of re-exports in total exports within the agro-complex is quite significant. Hence, substituting re-exports with locally produced exports is identified as one of the channels through which economic growth from diversification can be realised. In order to establish which re-exports could be substituted by local production,

the proximity of these products to the country's core competencies is analysed. Figure 6.26 below shows the agricultural product space with an indication of the products which are re-exported by South Africa, reflected by the solid squares. The figure re-affirms that re-exports constitute a large variety of products. The figure shows, furthermore, the re-exports that are connected to the country's core competencies, reflected by the solid triangles. The size of the nodes is proportional to the export value of the product, however, the triangle shaped nodes are inflated for visibility purposes.

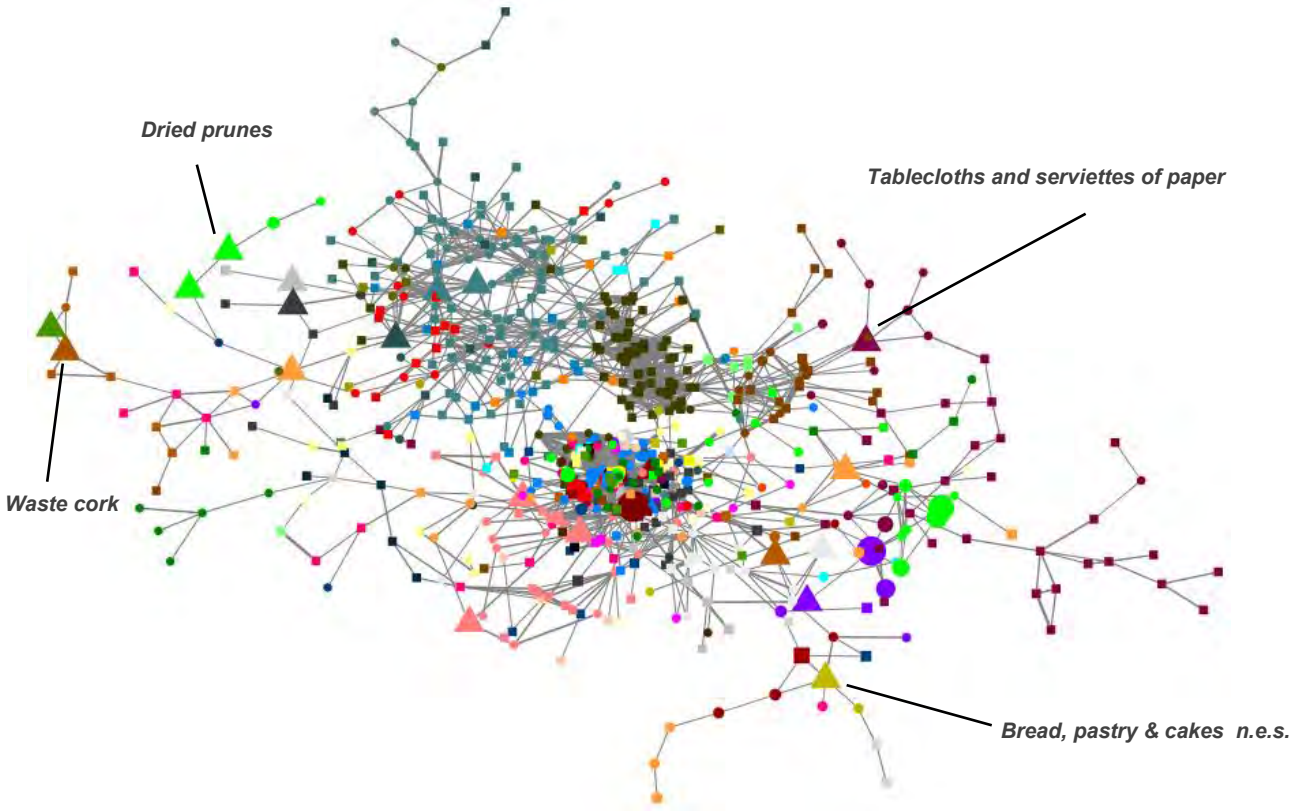


Figure 6.26: South Africa's re-exports in the agricultural product space
Source: Author's own calculations (2014)

It is evident from the figure that the scope for substituting re-exports by local production is limited. Twenty-two re-exported products are connected to the country's core competencies. This proximity to existing production makes the transfer of capabilities and the parallel diversification process to these specific products more feasible. A summary of these products is provided in Table 6.11 below.

The fifth column in the table shows the S*ubstitution opportunity value* for each opportunity. This value is calculated by taking the total export value of each product, weighted by the inverse of the *Distance* value (see Section 4.2.4) to the country's core competencies. A higher value implies superior prospects for substitution of re-exports. Hence, the products in Table 6.11 are ranked according to this indicator. The sixth column indicates whether the opportunity has strategic value in terms of export market potential. A positive strategic value is revealed if the product's export value is higher than its cluster's median value.

Table 6.11 shows that half of the re-exported products that can likely be locally produced are within the agro-processing of food cluster. Furthermore, the table indicates that only five out of the 22 opportunities reveal a positive strategic market potential.

Table 6.11: Diversification opportunities from substitution of re-exports

#	HS	Product	Cluster	Substitution value	Strategic export market value
(1)	(2)	(3)	(4)	(5)	(6)
1	200969	Grape juice, incl. grape must (excl. of 2009.61), unfermented & not cont. a ...	AF	5,055	Yes
2	310240	Mixtures of ammonium nitrate with calcium carbonate/oth. inorganic non-fert ...	AI	2,619	Yes
3	190590	Bread, pastry, cakes, biscuits & oth. bakers' wares n.e.s. in Ch.19, whethe ...	AF	2,025	Yes
4	180632	Chocolate & oth. food preps. cont. cocoa, in blocks/slabs/bars, weighing 2k ...	AF	1,049	Yes
5	843691	Parts of the poultry-keeping mach./poultry incubators & brooders of 8436.21 ...	AI	565	No
6	040390	Buttermilk/curdled milk & cream/kephir & oth. fermented/acidified milk & cr ...	AF	494	Yes
7	481830	Tablecloths & serviettes, of paper pulp/paper/cellulose wadding/webs of cel ...	FO	285	No
8	843820	Machinery for the mfr. of confectionery/cocoa/chocolate	AI	182	No
9	020442	Meat of sheep (excl. lamb & carcasses), frozen, bone-in	AF	160	No
10	220510	Vermouth & oth. wine of fresh grapes flavoured with plants/aromatic subs., ...	AF	156	No
11	081320	Prunes, dried	AF	135	No
12	030342	Yellowfin tunas (Thunnus albacares), frozen (excl. fillets/oth. fish meat o ...	AF	84	No
13	091020	Saffron	PA	36	No
14	020727	Cuts & edible offal of turkey, frozen	AF	35	No
15	470321	Chemical wood pulp, soda/sulphate, other than dissolving grades, semi-bleac ...	FO	31	No

(Table 6.11 continued)

#	HS	Product	Cluster	Substitution value	Strategic export market value
(1)	(2)	(3)	(4)	(5)	(6)
16	520949	Woven fabrics of cotton (excl. of 5209.41-5209.43), cont. 85%/more by wt. o ...	AN	26	No
17	080231	Walnuts, in shell	PA	21	No
18	200860	Cherries, prepd./presvd., whether or not cont. added sugar/oth. sweetening ...	AF	10	No
19	020732	Meat of ducks/geese/guinea fowls, not cut in pieces, fresh/chilled	AF	7	No
20	521149	Woven fabrics of cotton (excl. of 5211.41-5211.43), cont. <85% by wt. of co ...	AN	6	No
21	530929	Woven fabrics of flax (excl. of 5309.21), cont. <85% by	AN	4	No
22	450190	Waste cork; crushed/granulated/ground cork	FO	1	No

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs.

Source: Author's own calculations (2013)

6.4.5 Production of new export products

This section investigates the potential growth in the extensive margin from producing new export products to both new and existing markets (see also Section 3.6). The sustainability of capitalising on the exports of new products does not only depend on the relatedness of these new products to South Africa's current productive structure, but also on the export market potential of these products. Hence, diversifying production and developing new productive capabilities may require significant amounts of physical and human capital investments which need to be justified by adequate potential export volumes.

The results of the DSM, with regard to potential export values of the realistic export opportunities, are linked to the diversification opportunities stemming from both the country's core competencies and its overall productive structure. Figure 6.27 below shows the export opportunity network of the "low hanging fruits" since these products are directly linked to the country's core competencies. A total of 60 diversification opportunities are depicted with the respective size of the node representing the level of the *Export opportunity value* (see also Section 4.3.4).

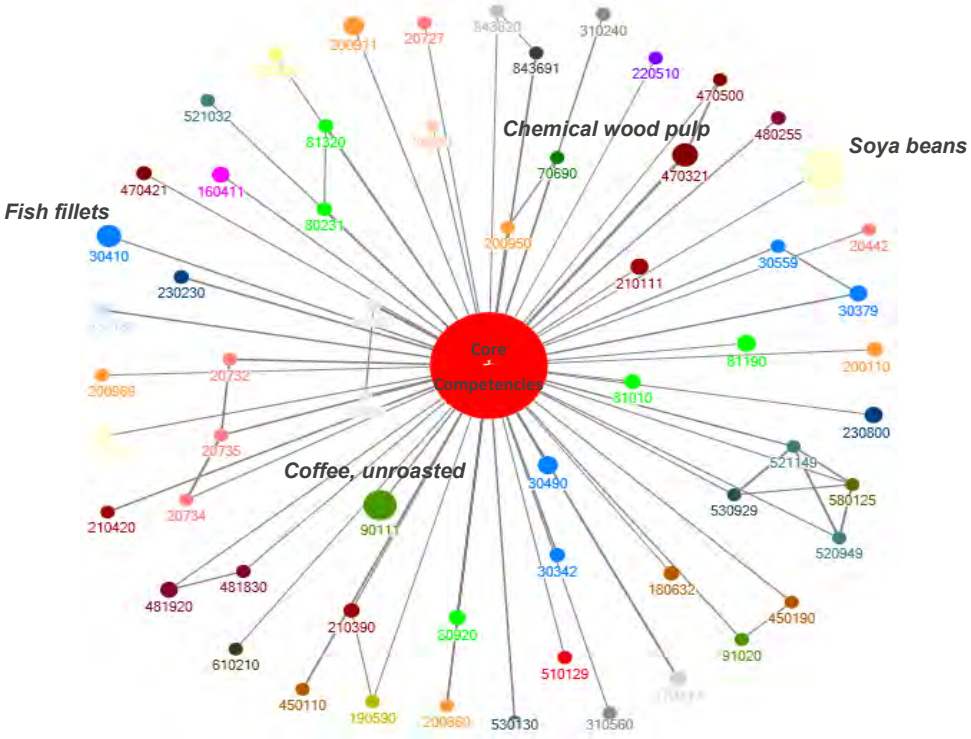


Figure 6.27: Export opportunity network of South Africa's core competencies
Source: Author's own calculations (2014)

It is evident from the figure that the *export opportunity values* are relatively low with a few exceptions, for example soya beans, chemical wood pulp, coffee and fish fillets. A complete overview of the top 15 new export opportunities is shown in Table 6.12 below. The products are ranked according to their respective *export opportunity values*. It is evident that most of the top new export opportunities are located in the agro-processing of food cluster. See Data Supplement VII for a complete overview of the 60 new export opportunities.

Table 6.12: Top new export opportunities derived from South Africa's core competencies

#	HS	Product	Cluster	Export opportunity value
1	120100	Soya beans, whether or not broken	PA	2,530,179
2	090111	Coffee, not roasted, not decaffeinated	AF	1,231,702
3	470321	Chemical wood pulp, soda/sulphate, other than dissolving grades, semi-bleac ...	FO	631,295
4	030410	Fish fillets & oth. fish meat, whether or not minced (excl. of 03.02), fres ...	AF	561,268
5	200911	Orange juice, frozen, unfermented & not cont. added spirit, whether or not ...	AF	319,299
6	030490	Fish meat other than fillets, frozen	AF	281,721
7	081190	Fruit & nuts, n.e.s., uncooked/cooked by steaming/boiling in water, frozen, ...	AF	210,914

(Table 6.12 continued)

#	HS	Product	Cluster	Export opportunity value
8	120600	Sunflower seeds, whether or not broken	PA	196,008
9	230800	Vegetable mats./waste/residues/by-prods., whether or not in pellets, of a k ...	AF	176,649
10	210111	Extracts, essences & concs. of coffee	AF	170,105
11	030379	Fish, n.e.s., frozen (excl. fillets/oth. fish meat of 03.04/livers & roes)	AF	163,104
12	160411	Salmon, prepd./presvd., whole/in pieces (excl. …..	AF	152,016
13	481920	Folding cartons, boxes & cases, of non-corrugated paper/paperboard	FO	149,259
14	170310	Cane molasses	AF	119,251
15	080920	Cherries, fresh	PA	112,015

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs.

Source: Author's own calculations (2014)

Table 6.13 below provides an overview of the contribution of each cluster to the total potential export value of all new exports identified for South Africa in the agricultural product space. The table shows that the largest contribution (45 per cent) is made by potential new exports from the primary agriculture cluster. New exports from the agro-processing of food cluster can also make a potentially significant contribution. New exports from both the agro-processing of non-food and agricultural inputs sector have little contribution to make. This trend does not directly correspond with Figure 6.20 which found that, for the total agro-complex, most potential for new exports was revealed in the forestry and agro-processing of non-food clusters. Hence, this illustrates that the position of a county in the product space, as determined by its productive structure, is decisive in determining the potential for new exports.

Table 6.13: Cluster contribution to potential value of new export derived from South Africa's core competencies in the agro-complex

Cluster	Share in total potential export value
Primary agriculture	45%
Agro-processing: food	35%
Agro-processing: non-food	1%
Forestry	18%
Agricultural inputs	1%

Source: Author's own calculations (2014) based on data from Steenkamp (2011)

Figure 6.28 below shows the export opportunity network for South Africa's overall productive structure in the agro-complex. A total of 217 new export opportunities are depicted in Figure 6.28. Developing production of these specific new export opportunities may prove to be difficult, since the majority of these are linked to existing products with a relatively lower level of specialisation. In correspondence with Figure 6.27, the export opportunities are dominated by a few products with a relatively large export market potential.

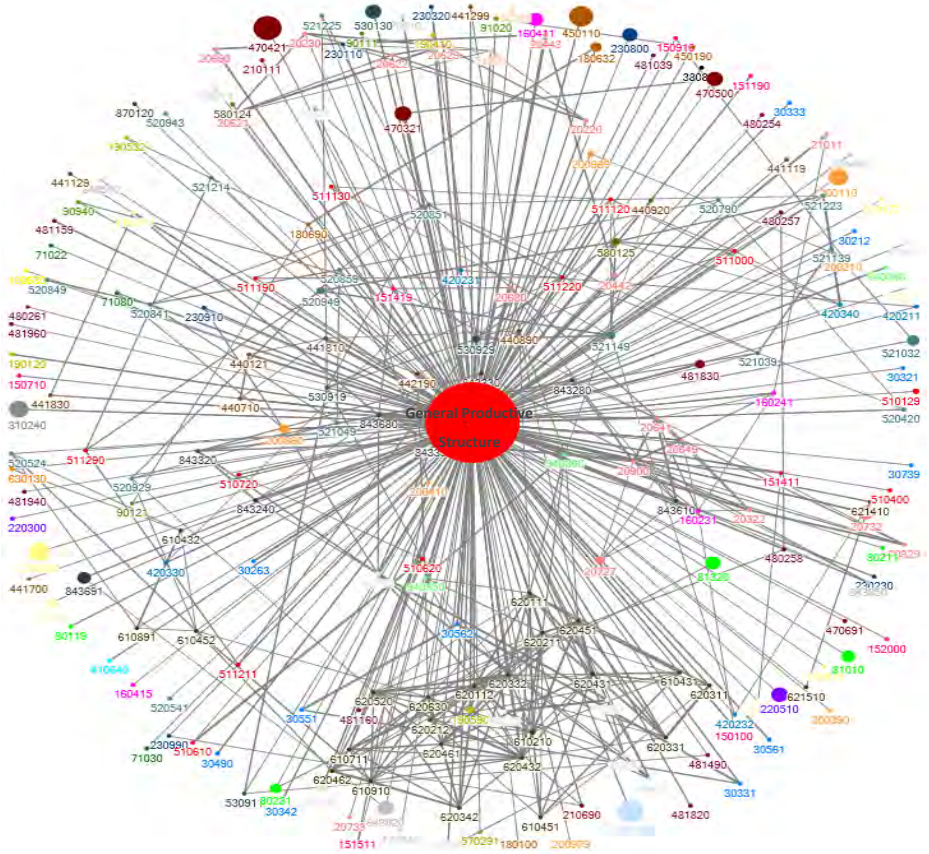


Figure 6.28: Export opportunity network of South Africa's general productive structure
Source: Author's own calculations (2014)

A complete overview of the top 15 new export opportunities derived from the country's overall productive structure is shown in Table 6.14 below. The potential export products are ranked according to their respective *Export opportunity value*. It is evident that most of the top new export opportunities are located in the forestry cluster. See Data Supplement VII for a complete ranking of the 213 new export opportunities.

Table 6.14: Top new export opportunities derived from South Africa's overall productive structure

#	HS	Product	Cluster	Export opportunity value
1	90111	Coffee, not roasted, not decaffeinated	AF	1,231,702
2	220300	Beer made from malt	AF	1,182,537
3	440710	Wood sawn/chipped length wise, sliced/peeled, whether or not planed, sanded ...	FO	1,048,468
4	180100	Cocoa beans, whole/broken, raw/roasted	PA	712,843
5	940360	Wooden furniture (excl. of 94.01 & 9403.30-9403.50)	FO	689,540
6	470321	Chemical wood pulp, soda/sulphate, other than dissolving grades, semi-bleac ...	FO	631,295
7	870120	Road tractors for semi-trailers (excl. of 87.09)	AI	474,548
8	442190	Articles of wood n.e.s. in Ch.44	FO	451,325
9	481940	Sacks & bags (excl. those having a base of a width of 40cm/more), incl. con ...	FO	360,200
10	210690	Food preps., n.e.s.	AF	343,632
11	441119	Fibreboard of wood/oth. ligneous mats., whether or not bonded with resins/o ...	FO	339,926
12	440920	Wood (incl. strips & friezes for parquet flooring, not assembled) continuou ...	FO	305,114
13	200979	Apple juice (excl. of 2009.71), unfermented & not cont. added spirit, wheth ...	AF	301,566
14	940340	Wooden furniture of a kind used in the kitchen	FO	287,854
15	940350	Wooden furniture of a kind used in the bedroom	FO	285,066

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs.

Source: Author's own calculations (2014)

Table 6.15 below provides an overview of the potential export values of all new exports derived from the overall productive structure for each cluster, as estimated within the DSM framework. The table shows that the largest contribution (i.e. 31 per cent) is made by export opportunities within the agro-processing of food cluster. New exports from the forestry and agro-processing of non-food clusters can also make a potentially significant contribution. Export opportunities from both the primary agriculture and agricultural inputs sector have little contribution to make to total exports. This trend does largely correspond with Figure 6.20.

Table 6.15: Cluster contribution to potential value of new exports derived from South Africa's overall productive structure

Cluster	Share in total potential export value
Primary agriculture	6%
Agro-processing: food	31%
Agro-processing: non-food	30%
Forestry	30%
Agricultural inputs	3%

Source: Author's own calculations (2014) based on data from Steenkamp (2011)

6.4.6 Import substitution of large imports

The substitution of imported products which can be competitively produced locally is another channel through which diversification can take place. These imports will have to be substantial in order to justify the development of new capabilities within the agro-complex. Hence, if the local market is small, the return on investments in new production capabilities and knowledge will likely be insufficient. Furthermore, to ensure the competitiveness of import-substitution endeavours, the product should be related to South Africa's current core competencies. This is measured by the distance of the product to South Africa's productive structure in the agricultural product space.

There are a few number of import products which have a relatively large import value and reveal a relative import specialisation within each of the five clusters (see Section 4.4.5 for the identification criteria). Within primary agriculture, there is a total of 17 of these imports, which include rice, wheat, tobacco, cotton, and vegetable seeds. The agro-processing of food cluster holds 74 such products, which include oil cake, palm oil, whiskies, and soya bean oil. A total of 69 large imports are identified within the agro-processing of non-food cluster, including T-shirts of cotton, men's trousers of cotton, woven fabrics of cotton, and cases of leather. Within the forestry cluster, a total number of 44 products with relatively high imports are identified, including natural rubber, sanitary towels, wooden furniture, and paperboard used for graphical purposes. A total of 19 products within the agricultural inputs cluster have a relative import value, which products include tractors, urea, potassium chloride, and herbicides. Some of these import products are already produced by South

Africa, but at a relatively low level of specialisation. Hence, these are also included in identifying opportunities for import substitution.

Figure 6.29 shows South Africa's level of imports in the agricultural product space. The size of the nodes is proportional to the country's total import value of that respective product. It is evident from the figure that rice, wheat and palm oil are the largest imports within the agro-complex.

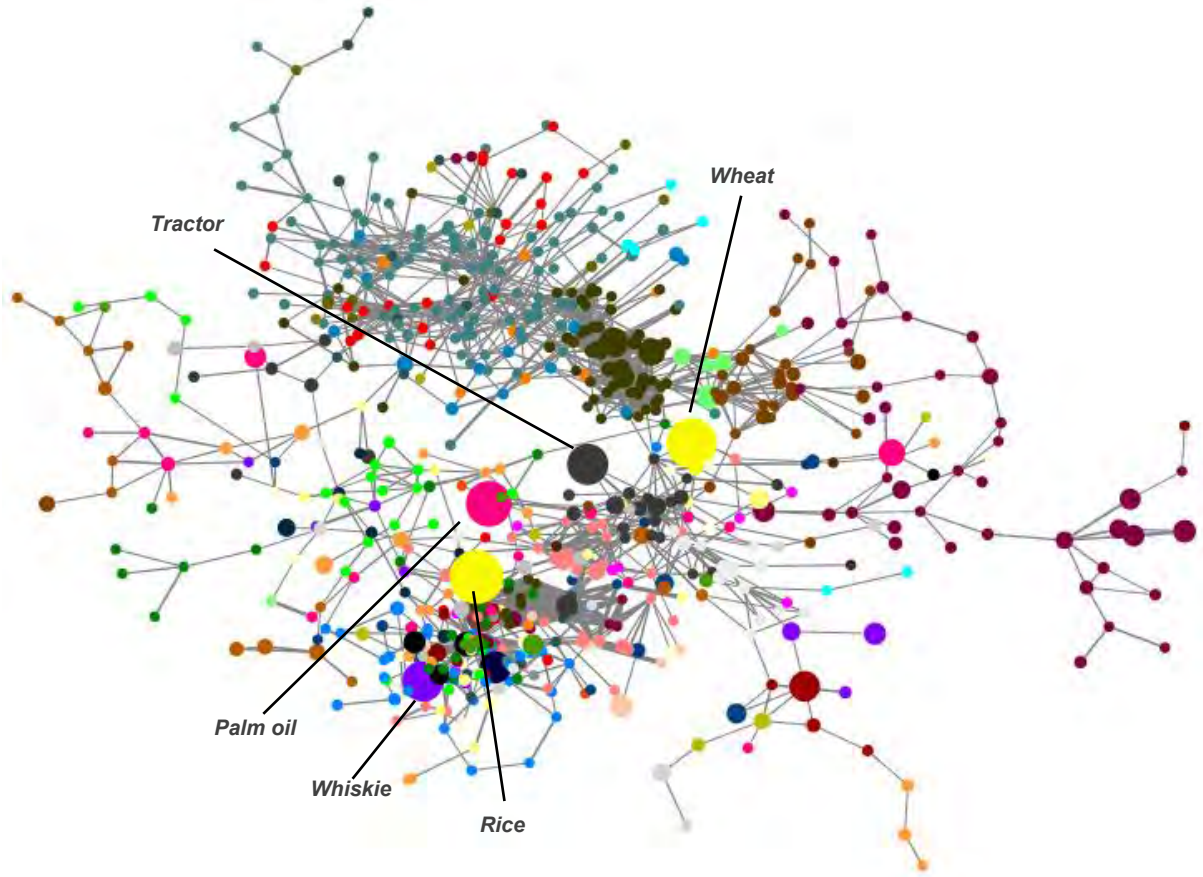


Figure 6.29: South Africa's imports in the agricultural product space
Source: Author's own calculations (2014)

However, not all of the large imports as depicted in figure 6.29 can be substituted by competitive local production. Import products connected to South Africa's core competencies can be competitively substituted very easily. This is because the set of capabilities required to produce them are largely similar to the existing capabilities embedded in the country's productive structure. Therefore, the *Distance value* (see Section

4.2.4) is used to weigh the import value opportunities of all the substitution opportunities. This measure is called the *Import-substitution opportunity value* (see also Section 4.4.5) and identifies the "low-hanging fruits" for competitive import-substitution.

Figure 6.30 below shows the opportunity network for import substitution stemming from the country's core competencies. It is evident from the figure that the scope for import substitution within South Africa's agro-complex is very low. Only six products are identified as competitive import-substitution opportunities which are related to the country's core competencies. The size of the nodes is proportional to their respective *Import-substitution opportunity value.*

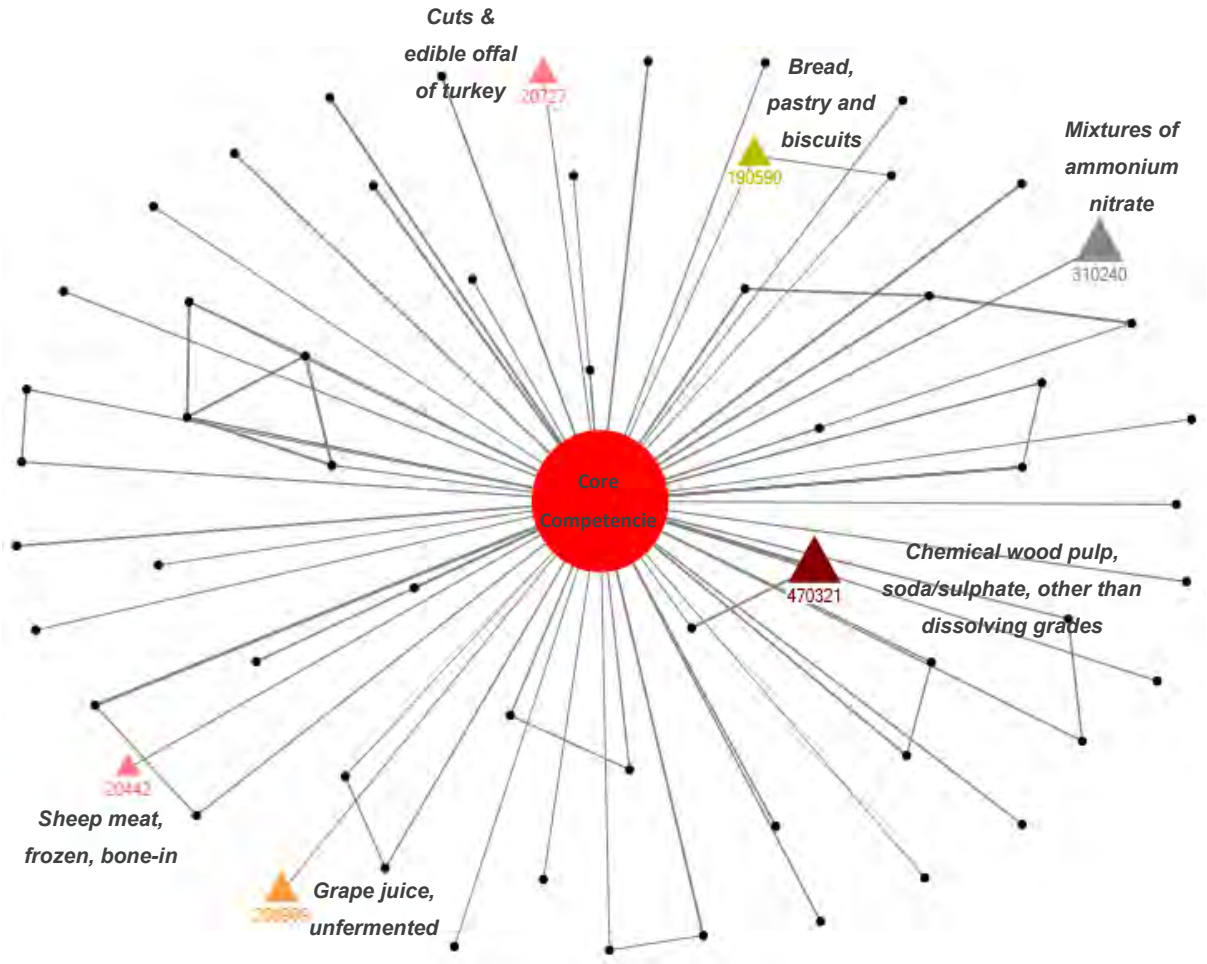


Figure 6.30: Import-substitution opportunity network of South Africa's core competencies
Source: Author's own calculations (2014) based on data from Steenkamp (2011)

The ranking of the six products according to their import-substitution opportunity value is as follows: 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. It is evident that four of the opportunities are within the agro-processing of food cluster.

The opportunities for import substitution are thus limited owing to a relatively small domestic market size and by the fact that the country does not have the adequate set of capabilities and knowledge related to the production of import substitutes. It is likely that the number of opportunities for import substitution will be larger in the country's overall productive structure. However, the transfer of capabilities from these products to the production of import substitutes will be much harder as the level of specialisation is lower.

6.4.7 Market diversification of existing exports

Expanding the market reach of existing export products to new markets is another channel through which market-driven export diversification can take place. Since this channel is based on existing products, no diversification pathways in the product space are identified. This potential growth of exports is within the so-called extensive margin (see Section 3.6). Section 3.8 revealed that past export growth within South Africa's extensive margin of the agro-complex was largely attributable to the exports of existing products to new markets.

The results of the DSM provide valuable insights into the potential for market diversification of existing products. The 70 products that comprise South Africa's core competencies in the agro-complex can potentially be exported to 12 additional markets, on average. Furthermore, if the country is able to capitalise on the total export potential to these new markets, its current value of exports of these 70 products might increase 11 times. The 216 products that comprise the overall productive structure of South Africa in the agro-complex can also potentially be exported to 12 additional markets, on average. The extra value of exports through market diversification could potentially add up to 12 times the current exports of these 216 products. This is just slightly more than the potential from its core

competencies. Hence, it is thus evident that the most potential for market diversification is embedded in the country's core competencies.

Figure 6.31 below shows the export market potential of South Africa's core competencies (i.e. solid triangles) in the agricultural product space. The size of the node is proportional to the number of potential new export markets of that respective product. The products with the most potential export markets include fish fillets, frozen (40); soups and broths (31); and paper and paperboard, not containing fibres obtained by mechanical processes (30). Most of the products with a relatively large number of potential export markets (more than ten markets) are within the agro-processing of food cluster. About 54 per cent of the country's core competencies have ten or more international market opportunities, as determined by the DSM.

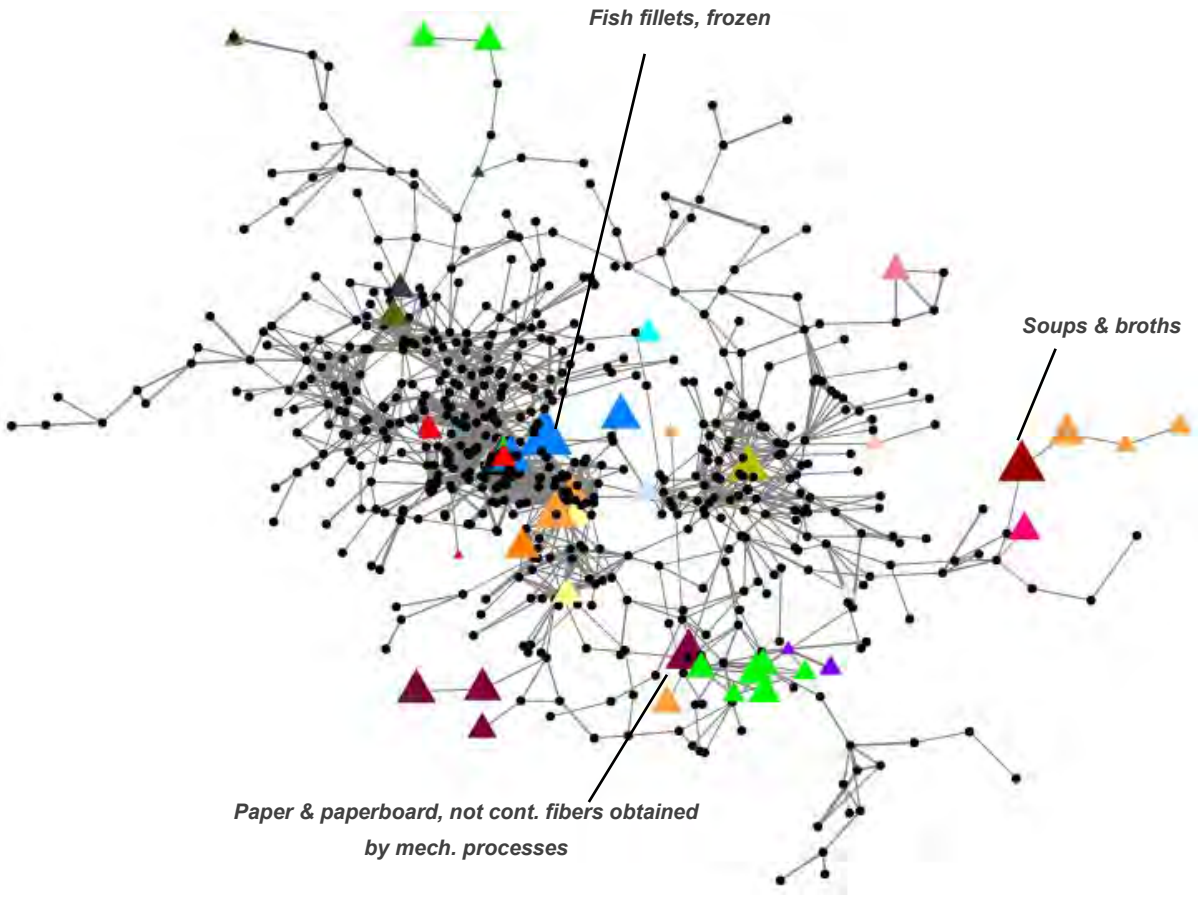


Figure 6.31: Export market potential of South Africa's core competencies in the agricultural product space

Source: Author's own calculations (2014) based on data from Steenkamp (2011)

The number of realistic new export markets does not reveal the potential value contribution of market diversification. Hence, Figure 6.32 below shows the potential export value of the market diversification opportunities of each of the country's core competencies in the agricultural product space. It is evident from the figure that a few of the products have a relatively large potential export value, but that the potential for the majority of the products is more moderate. The products with a relatively high potential export value from market diversification include cane sugar, raw; fish fillets, frozen; raw furskins; and flours, meals and pellets from fish, molluscs or crustaceans. Similar to the number of potential export markets, most of the products with a relatively high potential export value (more than 10 000 000 USD) are located within the agro-processing of food cluster.

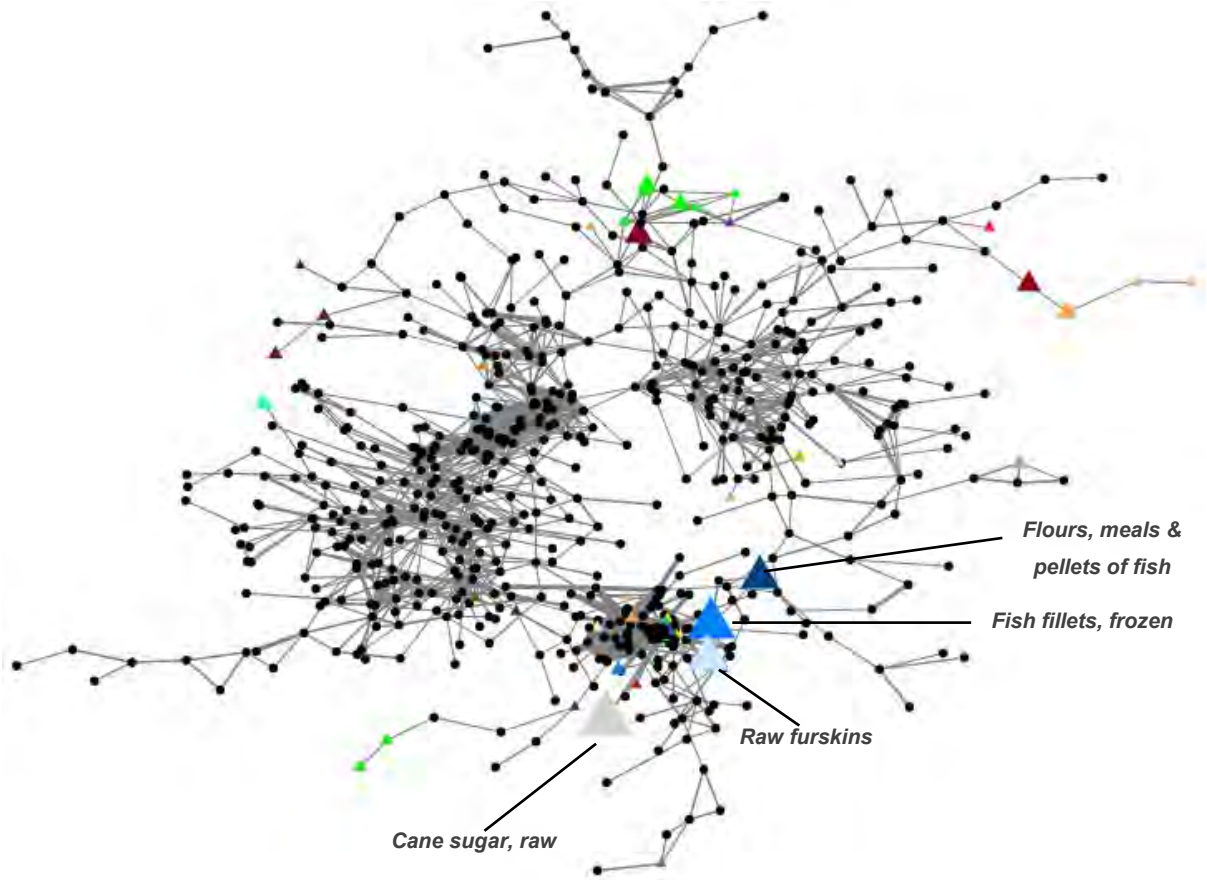


Figure 6.32: Potential export value from market diversification of South Africa's core competencies in the agricultural product space

Source: Author's own calculations (2014) based on data from Steenkamp (2011)

Table 6.16 below provides an overview of the top 15 core competencies with the highest potential for market diversification. It is evident that most of these top opportunities have

more than ten potential new export markets. Furthermore, most of the top ranked opportunities for market diversification fall within the primary agricultural cluster. A complete overview of the potential for market diversification is shown in Data Supplement VIII.

Table 6.16: Top opportunities for market diversification of core competencies

#	HS	Product	Cluster	Number of potential new export markets	Potential export value from market diversification (1 000 USD)
1	170111	Cane sugar, raw, in solid form, not cont. added flavouring/colouring matter ...	PA	9	586,333
2	030420	Fish fillets, frozen	AF	40	480,127
3	430110	Raw furskins, of mink, whole, with/without head/tail/paws	AN	10	342,203
4	230120	Flours, meals & pellets of fish/of crustaceans, molluscs/oth. aquatic inver ...	AF	19	295,824
5	480256	Paper & paperboard, not cont. fibres obt. by a mech./chemi-mech. process... ...	FO	30	146,621
6	081040	Cranberries, bilberries & oth. fruits of the genus Vaccinium, fresh	PA	15	146,506
7	100510	Maize (corn), seed	PA	6	140,427
8	210410	Soups & broths & preps. therefor	AF	31	98,446
9	030799	Molluscs & invertebrates (excl. of 0307.10-0307.60), frozen/dried/salted/in ...	AF	23	85,924
10	081020	Raspberries, blackberries, mulberries & loganberries, fresh	PA	10	66,606
11	510529	Wool tops & oth. combed wool other than combed wool in fragments	PA	7	63,794
12	110100	Wheat/meslin flour	AF	9	62,839
13	200899	Edible parts of plants, prepd./presvd., whether or not cont. added sugar/ot ...	AF	18	58,596
14	080930	Peaches, incl. nectarines, fresh	PA	17	51,447
15	080610	Grapes, fresh	PA	14	50,947

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs.

Source: Author's own calculations (2014) based on data from Steenkamp (2011)

This section provided guidance for market-driven diversification, an important imperative for the private sector. The next section investigates the social driver for diversification, namely the potential for employment creation.

6.5 EMPLOYMENT-DRIVEN DIVERSIFICATION

6.5.1 Introduction

As became evident in Section 1.2, South Africa has high levels of unemployment and poverty. Moreover, Section 2.3.6 indicated that employment is the single most important channel through which poverty can be alleviated. Against this background, the third strategic value of employment-driven diversification in the agro-complex is investigated here.

The structure of the agriculture product space is analysed in this section, as well as the position of South Africa therein and its implications for employment creation. Within the context of South Africa, producing "new" products with a higher potential for employment creation is an important strategic value. This is, however, a second-level imperative as the capitalisation of diversification opportunities needs to be driven foremost by market incentives. Moreover, no employment creation will occur without substantial growth in supply and demand.

This section investigates two dimensions of employment, namely quantity and quality. The quantity of employment is measured by labour intensity (see Section 4.5.2) and the quality of employment is measured by human capital intensity (see Section 4.5.3). The latter revolves around "better jobs". The first section provides a brief background on the employment structure in the agro-complex, and the second section discusses South Africa's diversification opportunities in the agricultural product space that are linked to employment creation. The third section links these with employment upgrading.

6.5.2 Employment in South Africa's agro-complex

Section 3.3.7 has already provided a broad indication of the employment structure in South Africa's agro-complex based on the International Standardised Industry Classification (ISIC). Figure 6.33 aggregates this structure into the clustering used in the analytical parts of this study. Since no detailed labour statistics are available for the production of agricultural

inputs, this cluster was omitted from the figure. It is evident that the primary agricultural cluster is by far the largest employer, followed by agro-processing of food, and forestry.

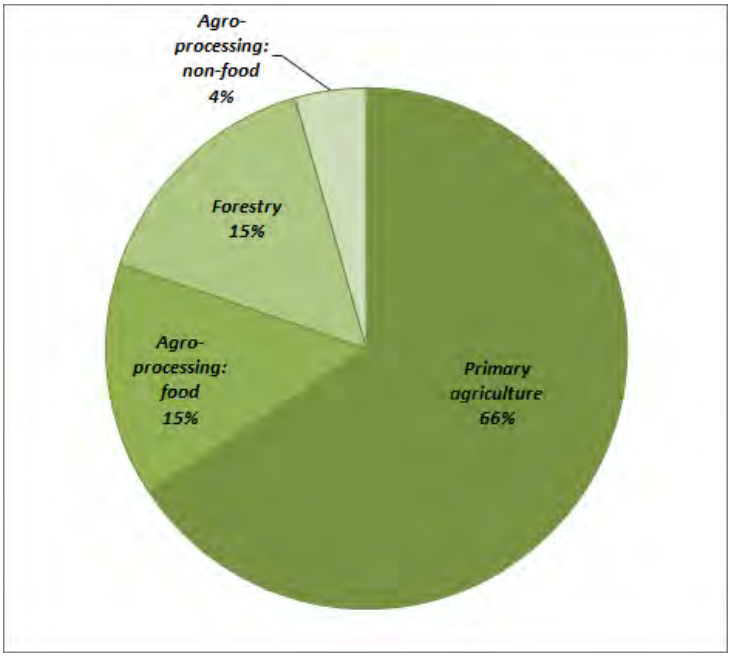


Figure 6.33: Broad employment structure in South Africa's agro-complex (2007[44])
Source: Author's own calculations based on data from StatsSA (2007)

6.5.3 South Africa's labour intensity in the agro-complex

Labour intensity measures the number of workers per one million Rand of output. Owing to local data constraints, this measure can only be calculated at sub-sector level, classified at the 3-digit level of the ISIC nomenclature. Hence, the labour intensities for a total of 25 of sub-sectors in South Africa's agro-complex were calculated. In order to allocate these labour intensities to the 1 456 products that comprise the agro-complex, a correspondence table linking the ISIC codes to the six-digit level of the HS nomenclature was used.

An overview of the labour intensities of the 27 sub-sectors in the agro-complex is provided in Table A.9 of Annexure II. Besides the absolute measure of labour intensity, the table also shows the normalised labour intensity index for each sub-sector (see Section 4.5.2). This index is equal to one for the highest labour intensity and equal to zero for the lowest labour

[44] Latest year available for relative disaggregated labour statistics

intensity. For purpose of this study, only relative values are of importance, hence, the normalised labour intensity index is used for the analysis in the agricultural product space.

Figure 6.34 below shows the distribution of the labour intensities per agricultural cluster, based on South Africa's production practices. It is evident that primary agriculture has the largest spread in labour intensity, which implies that it comprises products with a relatively low labour intensity, as well as products with the relatively highest labour intensity. Furthermore, its average labour intensity is also significantly larger than those of the other clusters. This implies that it has the best potential for employment creation.

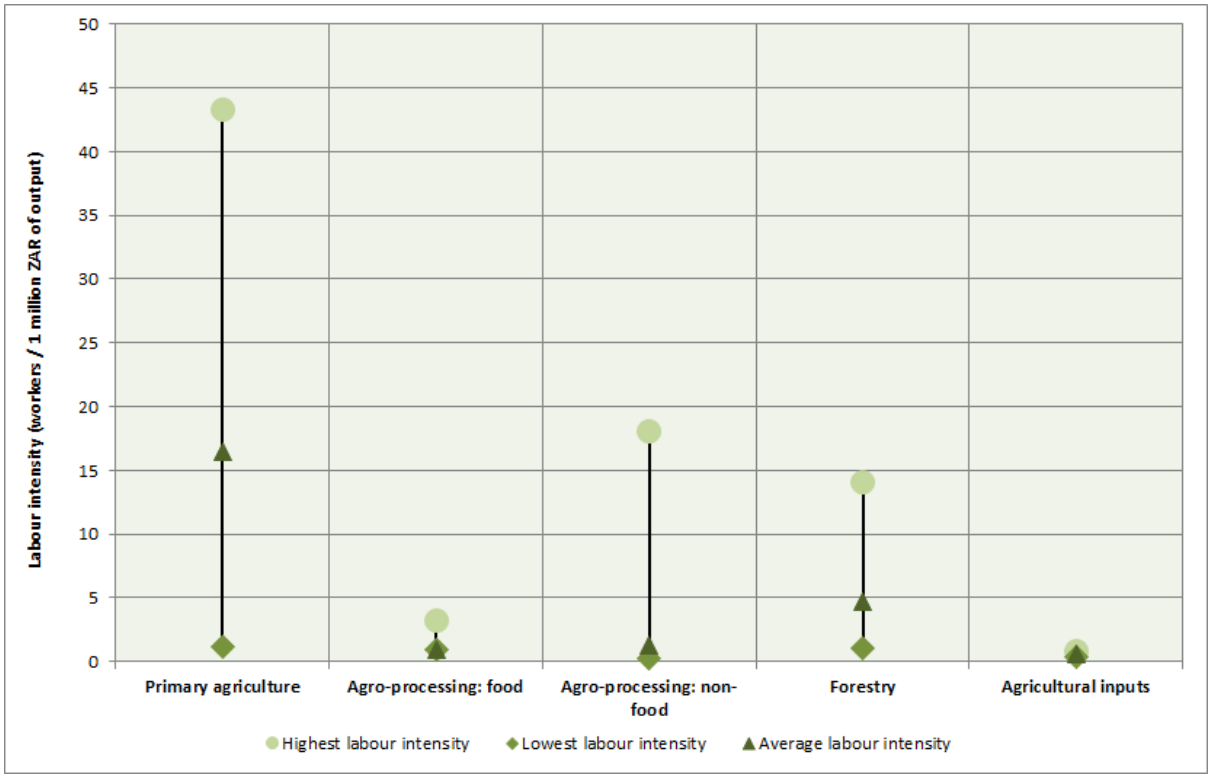


Figure 6.34: Distribution of labour intensities per agricultural cluster

Source: Author's own calculations based on data from StatsSA (2007), Quantec (2012) and DAFF (2013)

The spread within the agro-processing of non-food and forestry clusters is also relatively large. It is evident that these specific clusters also include some products with a relatively high level of labour intensity. The average labour intensity in South Africa's primary agriculture is 16.5 labourers per 1 million Rand of output. In the agro-processing of food,

agro-processing of non-food, forestry and agricultural inputs, the average labour intensities are 1.0, 1.3, 4.7 and 0.6 per one Million Rand of output, respectively. The labour intensity in these four clusters is thus considerably lower. For example, in order to create the same amount of employment as in primary agriculture, the output in the agro-processing of food cluster has to be on average 16.7 times higher, and the output in the agricultural input cluster has to be on average 26.6 times higher.

Figure 6.35 indicates the distribution of the labour intensity within South Africa's agricultural productive structure in the agricultural product space. The figure shows the average labour intensity index per cluster for the products produced and imported by South Africa, as well as for all products in the agricultural product space. It is evident from the figure that primary agriculture is by far the most labour intensive cluster within South Africa's product portfolio. This specific cluster represents 23 per cent of the total product portfolio and 66 per cent of employment (see Figure 6.17) in the agro-complex.

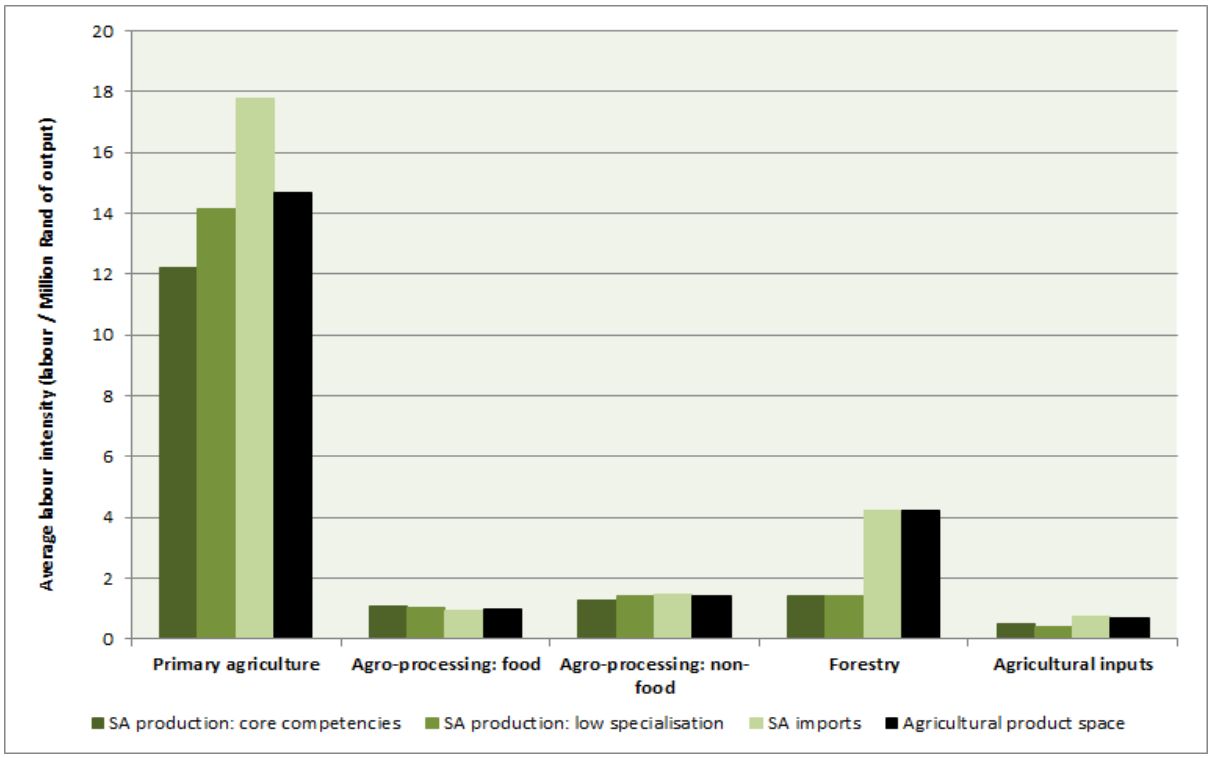


Figure 6.35: Labour intensity of South Africa's production per cluster in the agricultural product space

Source: Author's own calculations (2013)

Figure 6.35 shows, furthermore, that in the primary agriculture, agro-processing of non-food, forestry, and agricultural input clusters, the average labour intensity of South Africa's imports is higher than for its production. Only production in the agro-processing of food is more labour intensive on average than the country's imports of those products. This is a cumbersome situation against the background of South Africa's high employment and demand for employment creation, and is thus a rationale for import substituting diversification (see also Section 6.4.6)

The gap between South Africa's average labour intensity and the average for all products reveals the potential for employment from diversification in the agricultural product space. Hence, the largest employment gains from diversification in the agricultural product space can be expected from primary agriculture and forestry. Figure 6.35 also distinguishes between the average labour intensity of products for which the country has either a low or a high level of specialisation. This provides insights into whether the country's core competencies in the agricultural product space are focused on the more labour intensive products. Hence, this seems to be the case for agricultural inputs and the agro-processing of food. Within the other clusters, South Africa has the highest average labour intensity for products in which it has a relatively low level of specialisation. This relationship between the level of specialisation and the labour intensity in South Africa's agro-complex is further explored in Figure 6.34.

Figure 6.36 below shows South Africa's level of product specialisation, as reflected by the RTA index (y-axis) and the labour intensity index (x-axis) in the agricultural product space. The positive slope of the fit line indicates that the country has a higher level of specialisation in the more labour intensive products of the agro-complex. This is confirmed by the Pearson correlation analysis which shows a positive and significant (at the 0.05 level) coefficient of 0.08. However, this correlation is relatively weak and should be much higher in the light of the much-needed employment creation.

In terms of employment, importing less labour intensive products and producing and exporting more labour intensive products would be the most favourable path for South Africa. However, for structural economic development, employment creation is just one of

the sources of growth and should be balanced with increased knowledge, technology and capital intensity of production. Hence, the human capital intensity which measures the quality dimension of labour, i.e. the embedded skills and knowledge of products, will be discussed in Section 6.5.5.

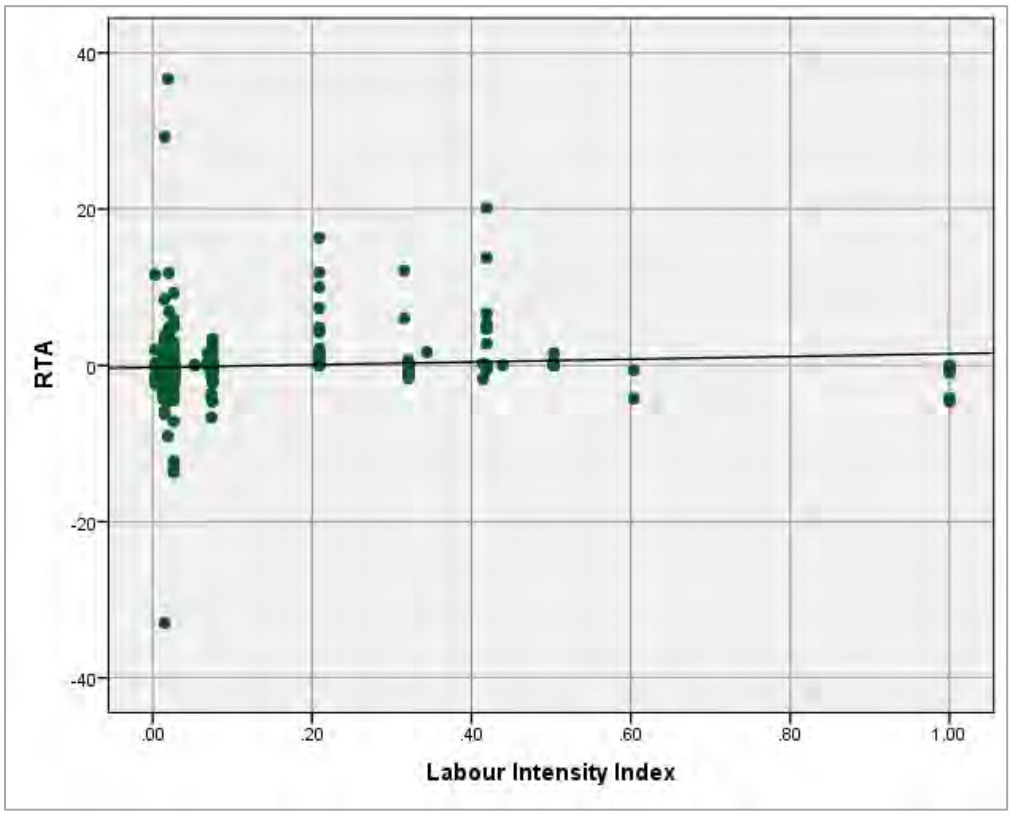


Figure 6.36: South Africa's level of product specialisation and labour intensity in the agricultural product space

Source: Author's own calculations (2013)

6.5.4 Diversifying for employment creation

Apart from employment creation arising from increased specialisation, the diversification of South Africa's product portfolio in the agro-complex may also hold opportunities for creating employment. Hence, the level of labour intensity in the agricultural product space is depicted in Figure 6.37 below. The size of the nodes is proportional to the respective labour intensity index of that product. Figure 6.37 shows that the proportion of the more labour intensive products, like most vegetables and fruits, seems to be more or less balanced between the denser and sparser parts of the agricultural product space.

Furthermore, the more clustered products in the network, like textiles, generally have a lower labour intensity.

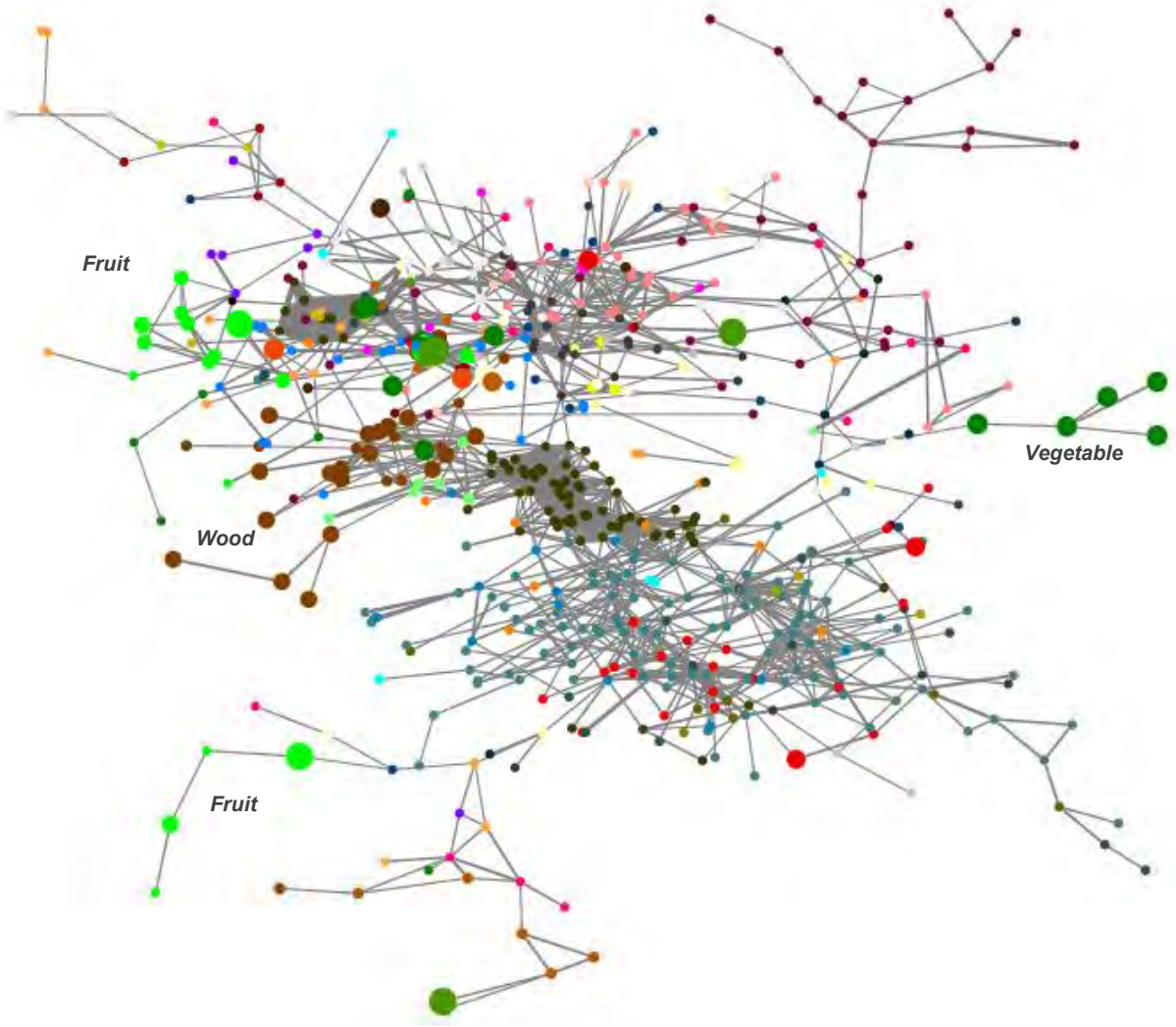


Figure 6.37: The level of labour intensity in the agricultural product pace
Source: Author's own calculations (2013)

The location of more labour intensive products in the network has important implications for diversifying to more labour intensive products in the agro-complex. Hence, it is more difficult for countries to diversify into the sparser parts of the network. Figure 6.38 below elaborates on this by examining the relationship between the *Centrality* and the labour intensity index for all 772 products in the agricultural product space. *Centrality* measures whether a product is located in the denser or sparser parts of the product space (see also

Section 4.2.4). A higher *Centrality* value indicates a more central location of the product in the agricultural product space.

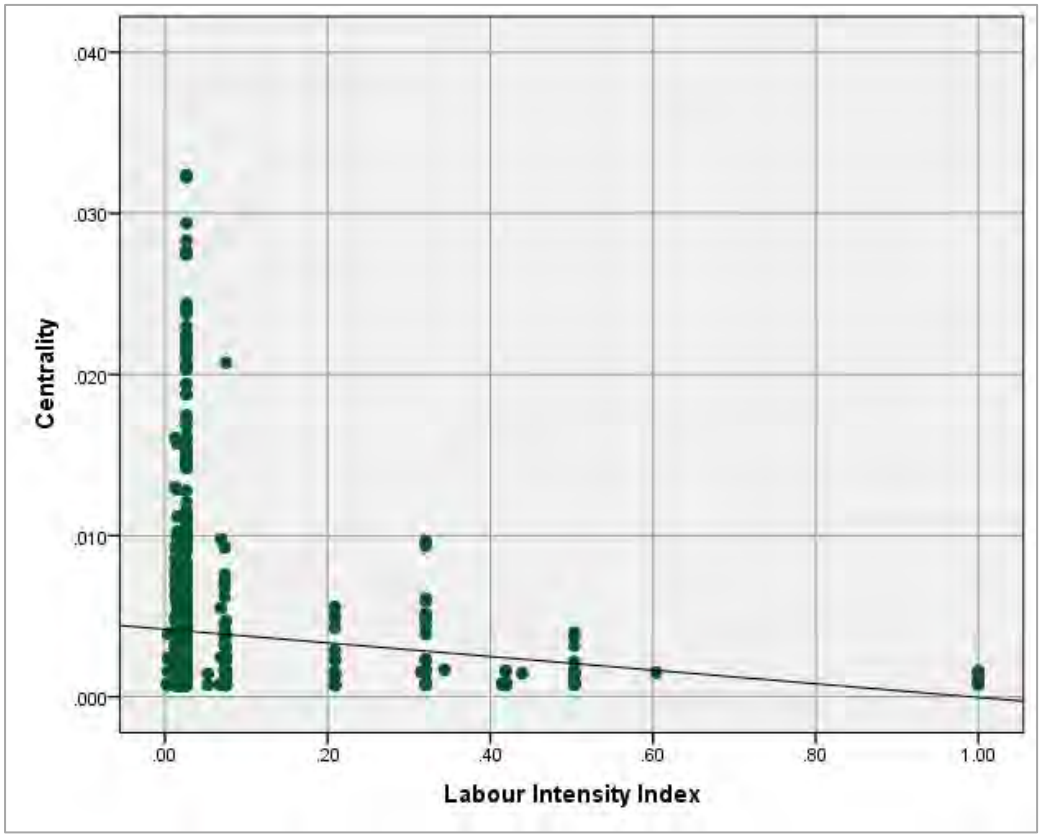


Figure 6.38: Location and labour intensity of products in the agricultural product space
Source: Author's own calculations (2013)

The negative slope of the fit line in Figure 6.38 reveals a negative relationship between *Centrality* in the product space and the labour intensity. This is further confirmed by Pearson correlation analysis which indicates a significantly (at the 0.01 level) negative correlation coefficient of -0.12. The more labour intensive products tend to be located in the sparser parts of the product space. However, this is not a very strong and conclusive correlation and, as visualised in Figure 6.37 above, a substantial proportion of labour intensive products are located in the sparser parts of the network.

In a universal sense, the location of labour intensive products in the product space is important, but from a country perspective it is more important how these products are located, relative to their productive structure. Diversifying production to "new" and more

labour intensive products within the agricultural product space is dependent on the proximity of these products to South Africa's existing productive structure. Hence, the measure of *Employment opportunity value* (see Section 4.5.2) is used to weight the labour intensity of products with the distance to a country's productive structure. The measure thus quantifies the value for employment creation of South Africa's diversification opportunities in the agricultural product space.

Figure 6.39 below depicts the opportunity network of South Africa's core competencies in the agricultural product space. The sizes of the nodes of the diversification opportunities are proportional to their *Employment opportunity value.*

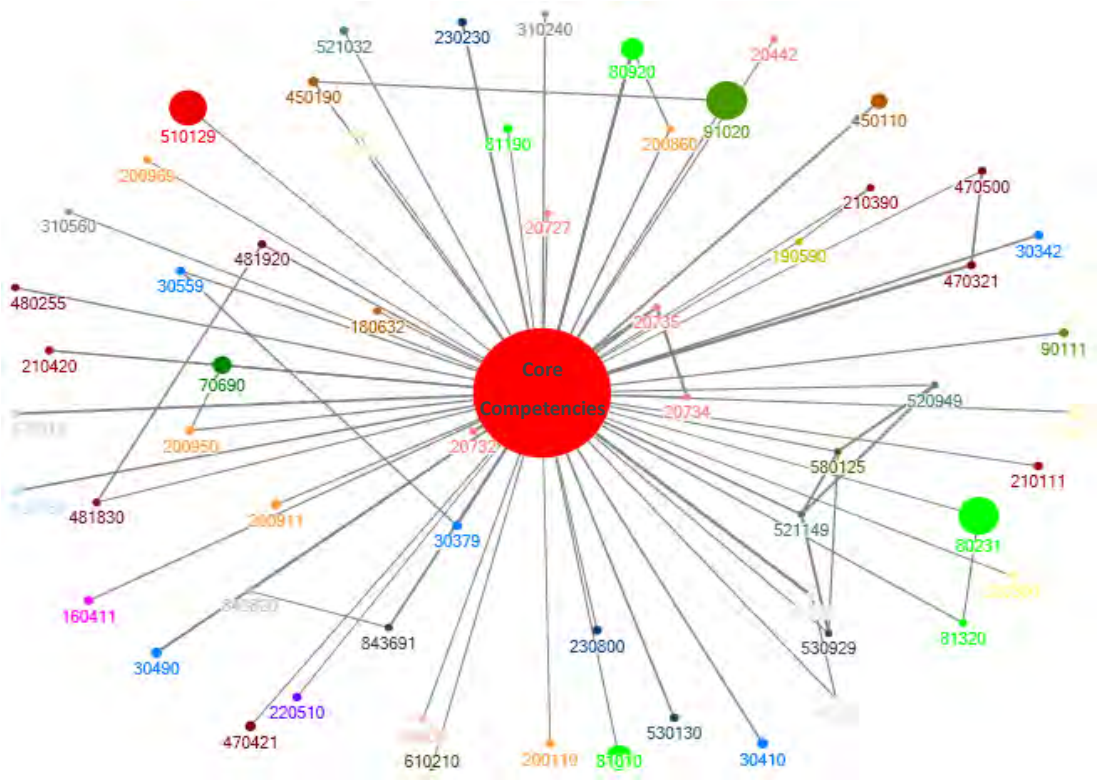


Figure 6.39: Employment opportunity value of SA's opportunity network of its core competencies

Source: Author's own calculations (2013)

It is evident from the figure that the potential for employment creation differs significantly among these 60 diversification opportunities, with only few products having a relatively high *Employment opportunity value*. These are "low-hanging fruits" for South Africa's

employment creation in the agro-complex. The *Employment opportunity value* in the opportunity network of South Africa's overall productive structure is shown in Figure 6.40 below. It is also evident that only a few of the 217 diversification opportunities embed large gains for employment.

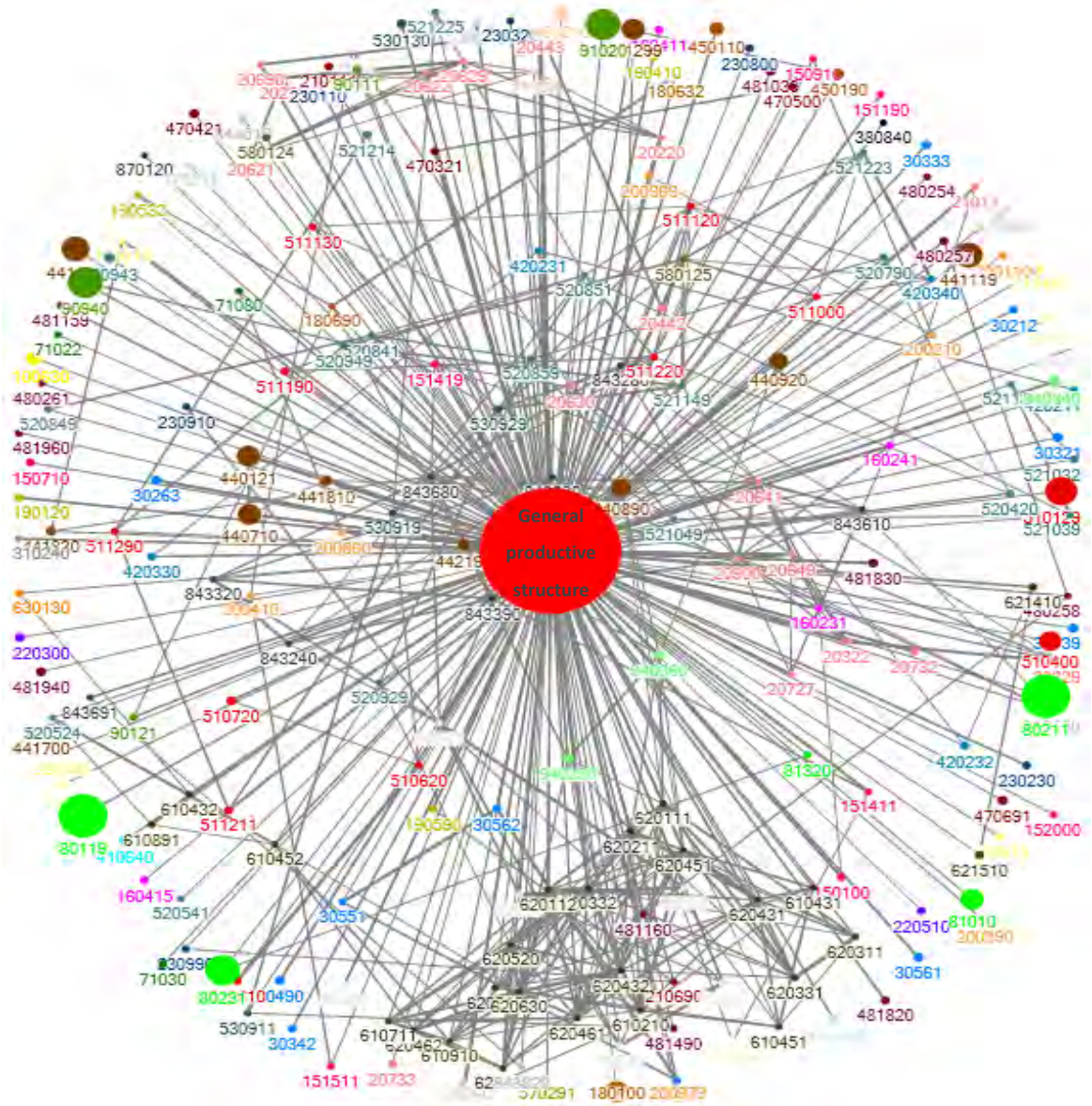


Figure 6.40: Employment value in South Africa's opportunity network of its overall productive structure in the agro-complex

Source: Author's own calculations (2013)

A summary of the employment creating potential of South Africa's diversification opportunities in the agro-complex is provided in Figure 6.41 below. The figure plots the

cumulative employment value for the clustered diversification opportunities in relation to the average distance of those opportunities to South Africa's current productive structure. The size of the bubbles is proportional to the total number of diversification opportunities in each cluster. Although the number of South Africa's diversification opportunities in primary agriculture is limited, it has the best prospects for creating employment from diversifying to "new" and nearby products.

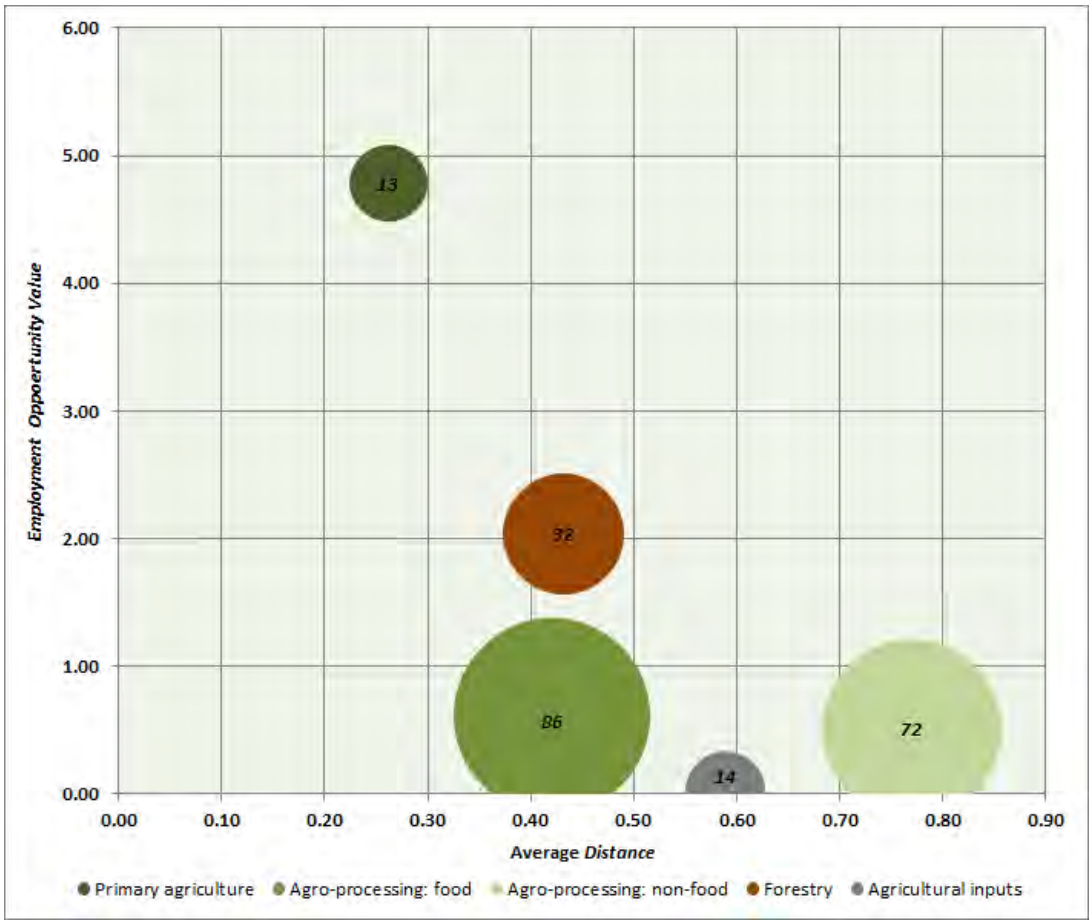


Figure 6.41: South Africa's diversification spectrum for employment creation in the agricultural product space

Source: Author's own calculations (2013)

When comparing Figure 6.41 with Figure 6.14 in section 6.3.5, which shows the diversification spectrum for structural transformation, it is evident that the clusters which hold the most potential for structural transformation via upgrading are not the ones that have the most potential for creating employment. This trade-off seems only limited for the forestry cluster.

Figure 6.41 shows, furthermore, that the potential employment creation from diversifying within the forestry cluster looks promising. Employment creation within the agro-processing clusters will have to come from capitalising on a wider range of the relatively abundant diversification opportunities, as well as from focusing on higher value products. Hence, the value added of a product can partly compensate for the effect of a lower labour intensity. For example, the unit value of a tractor is significantly higher than for a ton of mangoes, which implies that the labour intensity per unit of product is much more converged between these products than the labour intensity per unit of production output.

Hence, the labour intensity of products needs to be put into perspective with their respective product values. Using trade unit values based on exports (i.e. FOB values) for 2010 of all exporting countries[45], an average product unit value for all 1 456 products in the agro-complex is calculated. Subsequently, a categorisation between high value, medium to high value, medium to low value, and low value was made. This reveals that 30 per cent of the products in the agricultural product space can be classified as high value; a further 24 per cent is classified as high to medium value, 24 per cent as medium to low value, and 23 per cent as low value.

Figure 6.42 below provides an overview of the product values within each of the clusters in the agricultural product space. The product values are reflected by the median of the trade unit values of products. Owing to the prevalence of several outliers in each cluster, the median is a more appropriate measure. It is evident from the figure that the agro-processing of non-food cluster encompassed the most high-value products, followed by agricultural inputs. Their respective low levels of *Employment opportunity value* (see figure 6.25) can possibly be partly offset by higher product values. The figure shows, furthermore, that primary agriculture is dominated by low value products, whereas the product values in the forestry and agro-processing of food cluster are slightly higher.

[45] Source: CEPII (2013).

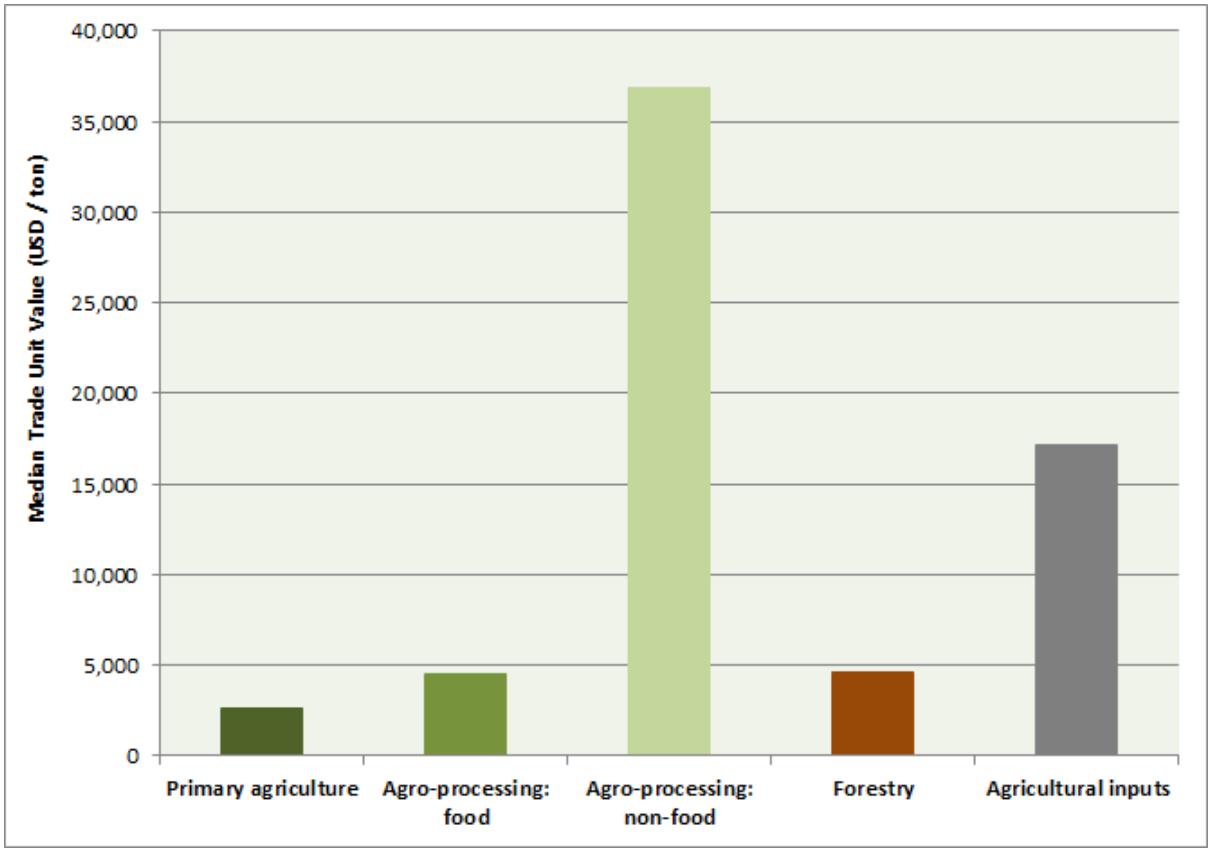


Figure 6.42: Overview of product values in the agricultural product space
Source: Author's own calculations based on data from CEPII (2013)

The top diversification opportunities within South Africa's agro-complex that have the highest potential for employment creation are shown in Tables 6.17 and 6.18 below. The opportunities are ranked according to their *Employment opportunity value*, which reflects the labour intensity, weighted by the distance of the product to South Africa's current core competencies. Furthermore, the level of labour intensity of the opportunities is indicated in the sixth column, which is categorised based on the intensities of all products in the agro-complex. The strategic value of the opportunity in the seventh column reflects whether its labour intensity can potentially contribute to a higher level of employment. If the opportunity has a higher labour intensity than South Africa's average for its cluster, it has a positive strategic value for employment creation. The last column shows the category of product value for each diversification opportunity, relative to the product values prevalent in the agro-complex. Although the *Employment value* is the most crucial determinant for successful diversification for employment, the last two dimensions provide further guidance for prioritisation.

Table 6.17 specifically shows the top diversification opportunities stemming from South Africa's core competencies. These are attainable in the short-term, as the country already has well-developed capabilities in current production, to which these diversification opportunities are linked. Furthermore, the diversification opportunities in the table include some products already produced by South Africa, but with a low level of specialisation (highlighted in bold). Hence, building stronger ties with these products will further enhance their development. Given the generally high level of labour intensity in primary agriculture, many products from that specific cluster feature high in the ranking of Table 6.17. However, the strategic value for South Africa of half these top opportunities is limited. Furthermore, they have, in general, relatively lower product values.

Table 6.17: South Africa's top 10 diversification opportunities from its core competencies with high potential for employment creation

#	HS	Product	Cluster*	Employment opp. value	Labour intensity	Strategic value	Product value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	091020	Saffron	PA	0.500	High	Yes	High value
2	080231	Walnuts, in shell	PA	0.488	High	Yes	Low to medium value
3	510129	Wool, not carded/combed, degreased, not carbonised, other than shorn	PA	0.420	High	Yes	Low to medium value
4	081010	Strawberries, fresh	PA	0.210	High	No	Low to medium value
5	***080920***	***Cherries, fresh***	***PA***	***0.151***	***High***	***No***	***Low to medium value***
6	***070690***	***Salad beetroot, salsify, celeriac, radishes & sim. edible roots***	***PA***	***0.096***	***High***	***Yes***	***Low value***
7	120600	Sunflower seeds, whether or not broken	PA	0.080	High	No	Low value
8	**450110**	**Natural cork, raw/simply prepd.**	**FO**	**0.070**	**High**	**No**	**Medium to high value**
9	***120100***	***Soya beans, whether or not broken***	***PA***	***0.038***	***High***	***No***	***Low value***

(Table 6.17 continued)

#	HS	Product	Cluster*	Employment opp. value	Labour intensity	Strategic value	Product value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
10	430160	Raw furskins, of fox, whole, with/without head/tail/paws	AN	0.030	Medium	Yes	High value

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs.

Source: Author's own calculations (2013)

Table 6.18 elaborates on Table 6.17 by taking South Africa's total productive structure in the agro-complex as a basis for diversification. The dominance of primary agriculture in this top 10 is evident. None of these opportunities are currently produced by South Africa. Furthermore, not all existing production capabilities in this general productive structure may be as well-developed as in the country's core competencies. This may imply that some diversification opportunities are more difficult to realise. Therefore, the opportunities originating from the country's core competencies are highlighted in bold.

Table 6.18: South Africa's top 10 diversification opportunities from its overall productive structure with high potential for employment creation

#	HS	Product	Cluster *	Employment opp. value	Labour intensity	Strategic value	Product value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	080119	Coconuts, other than desiccated	PA	1.000	High	Yes	Low value
2	080211	Almonds, in shell	PA	1.000	High	Yes	Low to medium value
3	090940	Seeds of caraway	PA	0.500	High	Yes	Low to medium value
4	***091020***	***Saffron***	***PA***	***0.500***	***High***	***Yes***	***High value***
5	***080231***	***Walnuts, in shell***	***PA***	***0.490***	***High***	***Yes***	***Low to medium value***
6	510129	Wool, not carded/combed, degreased, not carbonised, other than shorn	PA	0.420	High	Yes	Low to medium value
7	441119	Fibreboard of wood/oth. ligneous mats., whether or not bonded with resins	FO	0.320	High	Yes	Low value

(Table 6.18 continued)

#	HS	Product	Cluster *	Employment opp. value	Labour intensity	Strategic value	Product value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8	441129	Fibreboard of wood/oth. ligneous mats., whether or not bonded with resins	FO	0.320	High	Yes	Low value
9	180100	Cocoa beans, whole/broken, raw/roasted	PA	0.220	High	Yes	Low to medium value
10	440121	Wood, in chips/particles, coniferous	FO	0.214	High	Yes	Low value

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs

Source: Author's own calculations (2013)

A comprehensive overview of the employment creation potential of all diversification opportunities stemming from South Africa's general productive structure in the agro-complex is provided in Data Supplement IX. The diversification opportunities with links to South Africa's core competencies are marked in bold.

6.5.5 South Africa's human capital intensity in the agro-complex

The previous section analysed the link between diversification opportunities and the creation of employment by assessing the labour intensity of these products. This section looks more specifically at the quality dimension of labour in the agro-complex and in South Africa specifically, which implies creating "better" jobs. The next section analyses the link between this dimension of labour and the diversification pathways in the agricultural product space. Within the South African context, employment creation is a top priority in the short- to medium-term. However, the upgrading of employment towards more high-skilled and knowledge-intensive occupations is an inevitable element of long-term sustainable economic development in agriculture and other economic sectors. As Barro (1991) empirically tested, human capital is strongly related to economic growth.

The quality dimension of labour can be measured by the Revealed Human Capital Index (RHCI), as developed by Shirotori *et al*. (2010). This measure allocates a revealed level of

human capital, proxied by the average years of schooling, weighted by the RCA indices of the countries producing a good, to each product at the HS6 level.

An overview of the distribution of human capital intensity within the five clusters of the agro-complex is provided in Figure 6.43 below. The highest average human capital intensity can be found in the agricultural input cluster. This is not surprising, given that this cluster involves machinery and chemical products which require high-skilled labour and knowledge. The forestry cluster also has a relatively high level of human capital. The lowest average level of human capital can be found in the agro-processing of non-food cluster, which is dominated by textiles, followed by primary agriculture. The figure also indicates the spread of human capital intensity per cluster. This reveals that the highest human capital intensity can be found in the agro-processing of food sector. This cluster also has the largest variety in human capital, followed by primary agriculture.

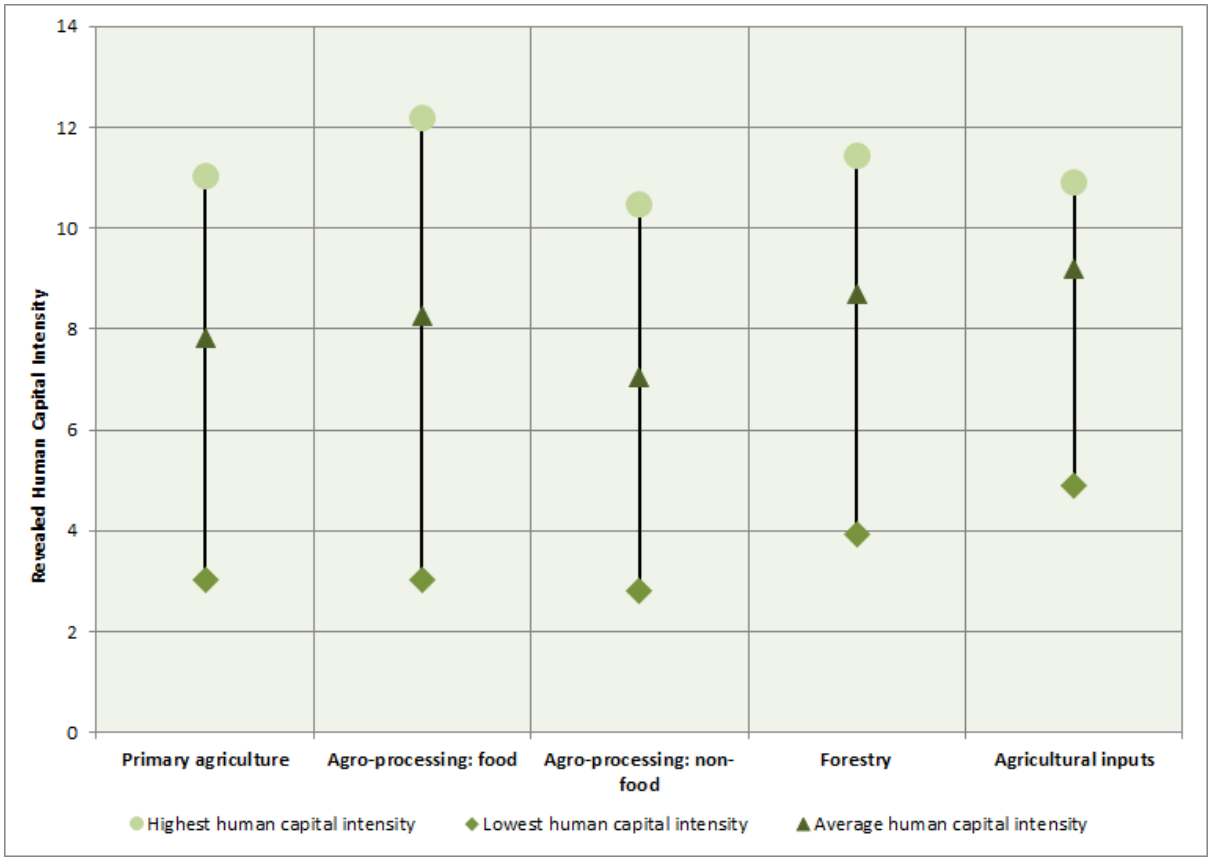


Figure 6.43: Distribution of human capital intensities per agricultural cluster
Source: Author's own calculations (2013) based on data from Shirotori et al. (2010)

An overview of the level of human capital intensity for South Africa's productive structure in the agricultural product space is provided in Figure 6.44 below. The country's production is separated into high- and low-specialisation and the figure also shows the human capital intensity of its imports, as well as for the agricultural product space at large. The Figure reveals that South Africa's human capital intensity in primary agriculture is on par with its imports and the general level in that cluster. However, its human capital intensity in its core competencies in primary agriculture is lower than for the products in which the country has a relatively low level of specialisation. The opposite situation should be preferred.

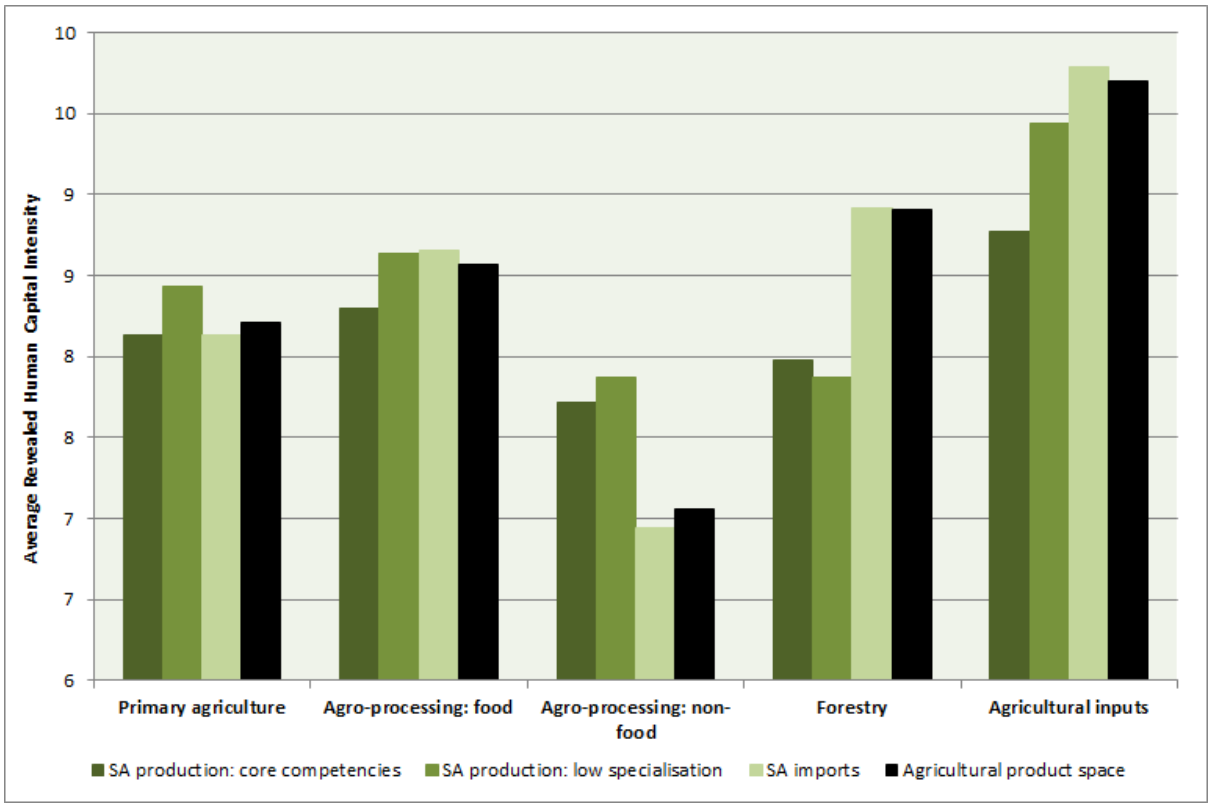


Figure 6.44: Human capital intensity of South Africa's production per cluster in the agricultural product space

Source: Author's own calculations (2013) based on data from Shirotori et al. (2010)

The country's human capital intensity in agro-processing of food could be improved, as its core competencies in that sector are lagging behind those levels found in its low production specialisation, its imports, and the general level of this specific cluster in the agricultural product space. South Africa's level of human capital intensity in the agro-processing of non-food cluster is relatively high. Figure 6.45 shows that its level of human capital intensity in

production is significantly higher than for its imports and the general level in that specific cluster. The human capital intensity of South Africa's production in the forestry cluster is significantly lower than for its imports, as well as compared to the general intensity level in that cluster. A similar trend is prevalent in the agricultural inputs cluster, although this cluster has the highest level of human capital intensity in the country's productive structure.

Analysis in section 3.7.3 revealed that South Africa has a relatively large gap between its endowment level of human capital and the revealed level of human and physical capital of most of its products in the agro-complex. This gap is further analysed in Figure 6.45 below, which shows the distance between the human capital intensity of each product and South Africa's human capital endowment (e.g. 7.9 years of schooling)[46] in relation to the country's level of specialisation in that respective product (x-axis).

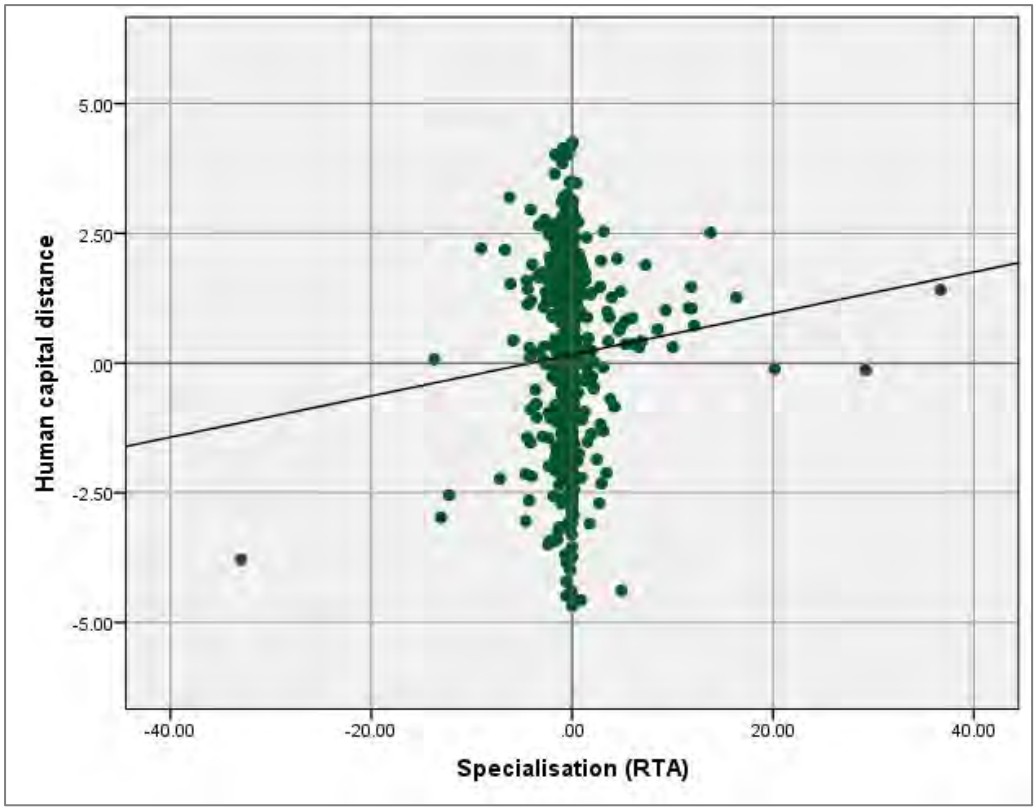


Figure 6.45: South Africa's level of product specialisation and human capital gaps in the agricultural product space

Source: Author's own calculations (2013)

[46] As estimated by Shirotori *et al.* (2010). Latest year available is 2007.

The figure shows that a relatively significant proportion of the products in which South Africa is specialised are located in the upper-right quadrant, which implies a relatively large gap with the country's human capital endowment. In fact, 68 per cent of the products in which South Africa has developed a revealed specialisation embed a higher level of human capital than the country's endowment. The group predominantly consists of processed food and forestry products. In the long run, this condition of the labour factor puts significant strain on the sustainability of production and exports of these products.

Structural transformation to more complex products in the agro-complex (see Section 6.3) will increase the demand for higher skilled labour. This is underpinned by a relatively high and statistically significant (at the 0.01 level) correlation coefficient of 0.52 between human capital intensity (e.g. RHCI) and complexity (e.g. PCI) of the products in the agro-complex. Furthermore, pressure from local labour policies will likely result in increased mechanisation, which also requires skilled labour. Hence, diversifying to products which require a higher level of human capital is not realistic without significant progress in South Africa's human capital development in agriculture. Currently, only approximately four per cent of the labour force in agriculture is highly-skilled, although this proportion has been slowly on the rise (Quantec, 2012).

6.5.6 Diversifying for employment quality

This section analyses the link between the quality dimension of labour and South Africa's diversification pathways in the agricultural product space. Hence, the respective diversification opportunities each embed different potentials for increasing the human capital intensity of South Africa's agro-complex. The level of human capital intensity in the agricultural product space is shown in Figure 6.46 below. The size of the node of each of the respective products is proportional to the level of intensity of human capital associated with its production.

It is evident from this figure that the human capital intensity is also relatively high in the periphery of the agricultural product space. Furthermore, some of the more centrally located and densely connected product groups, such as fabrics and textiles of natural fibres,

have a relatively low level of embedded human capital. This pattern has implications for the amount of pathways available for diversifying to more human capital intensive products in the agro-complex. Hence, it is more difficult for a country to diversify into the sparser parts of the network, as the number of pathways for "jumping" to new products is limited.

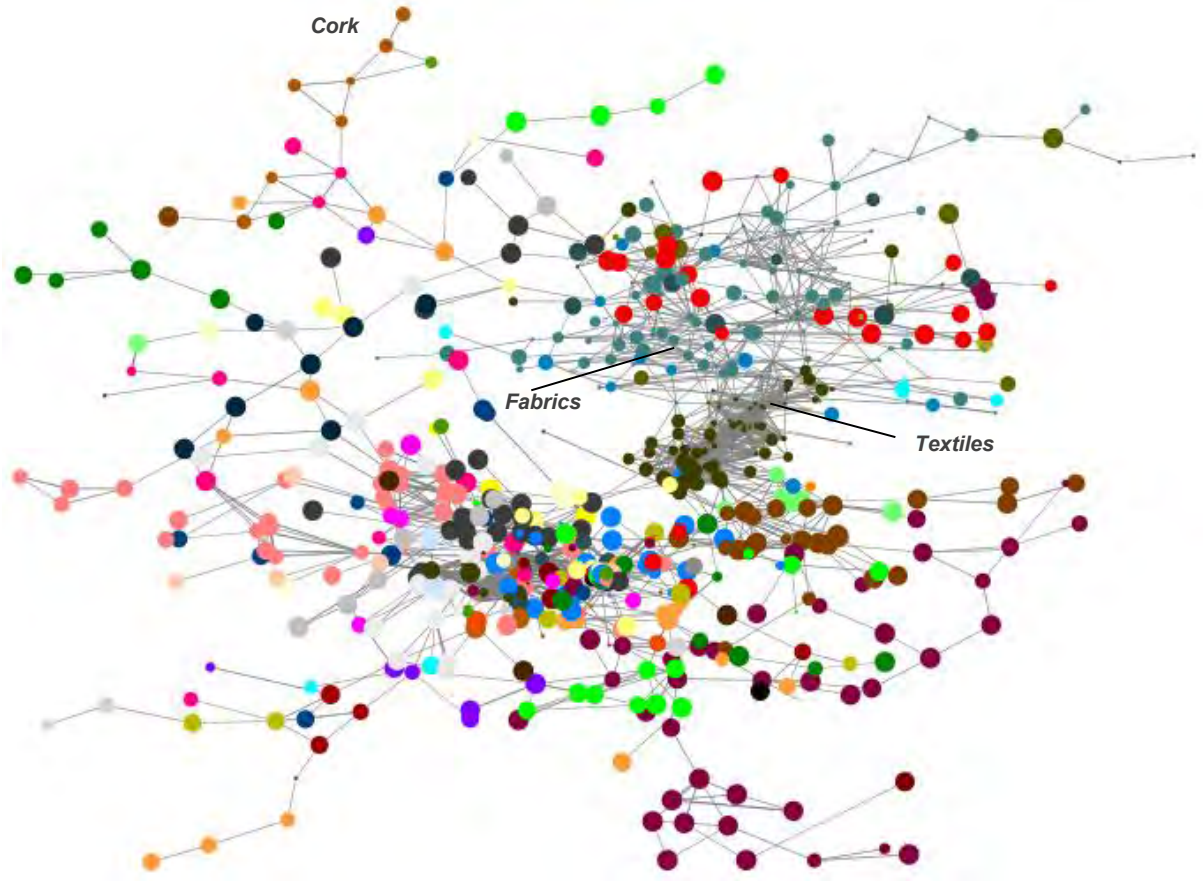


Figure 6.46: The level of human capital intensity in the agricultural product pace
Source: Author's own calculations (2013)

The relationship between the location in the agricultural product space and the human capital intensity of products is further analysed in Figure 6.47 below. The measure of *Centrality* is used to determine the connectedness and position of products in the network. A higher *Centrality* value indicates a more central location of the product. The x-axis depicts the standardised RHCI. The figure shows that the location and connectedness of products seem relatively scattered across the broad range of human capital intensity. The negative slope of the fit line, however, indicates that the products with higher human capital intensities are less centrally located and thus less connected in the agricultural product

space. Further analysis of the statistical relationship between *Centrality* and human capital intensity reveals a significant but relatively weak correlation between the two indicators. The correlation coefficient is -0.18 which is significant at the 0.01 level. Hence, this relatively weak relationship implies that diversifying into more human capital intensive products within the agricultural product space should generally not pose too much of a challenge. For an individual country, like South Africa, this is further dependent on its position in the network.

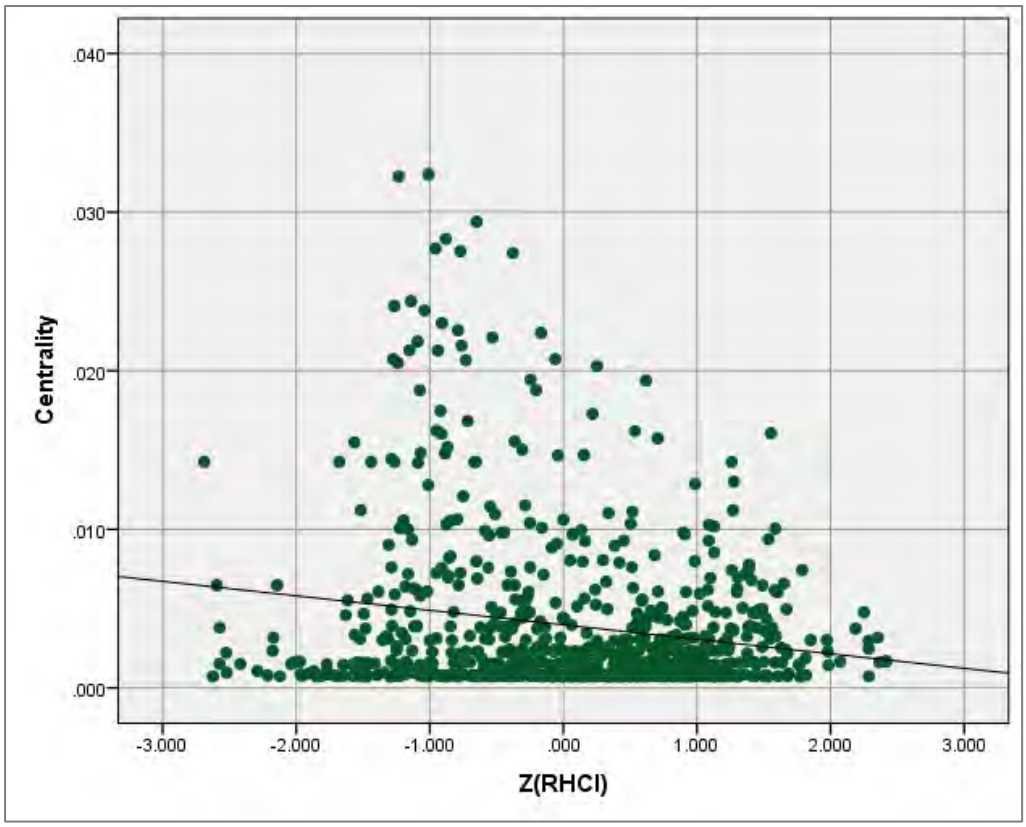


Figure 6.47: Location and human capital intensity of products in the agricultural product space

Source: Author's own calculations (2013)

Diversifying production to "new" and human capital intensive products is dependent on the proximity of these products to South Africa's existing productive structure. Hence, the measure of *Human capital value* (see Section 4.5.3) is used to weight the human capital intensity of products with the distance to a country's productive structure. The measure thus quantifies the value for labour quality of South Africa's diversification opportunities in

the agricultural product space. Given South Africa's current level of human capital, these diversification opportunities form a push-incentive for targeted skills and knowledge development in specific parts of the agro-complex.

Figure 6.48 below depicts the opportunity network of South Africa's core competencies in the agricultural product space. The sizes of the nodes of the diversification opportunities are proportional to their *Human capital opportunity value.*

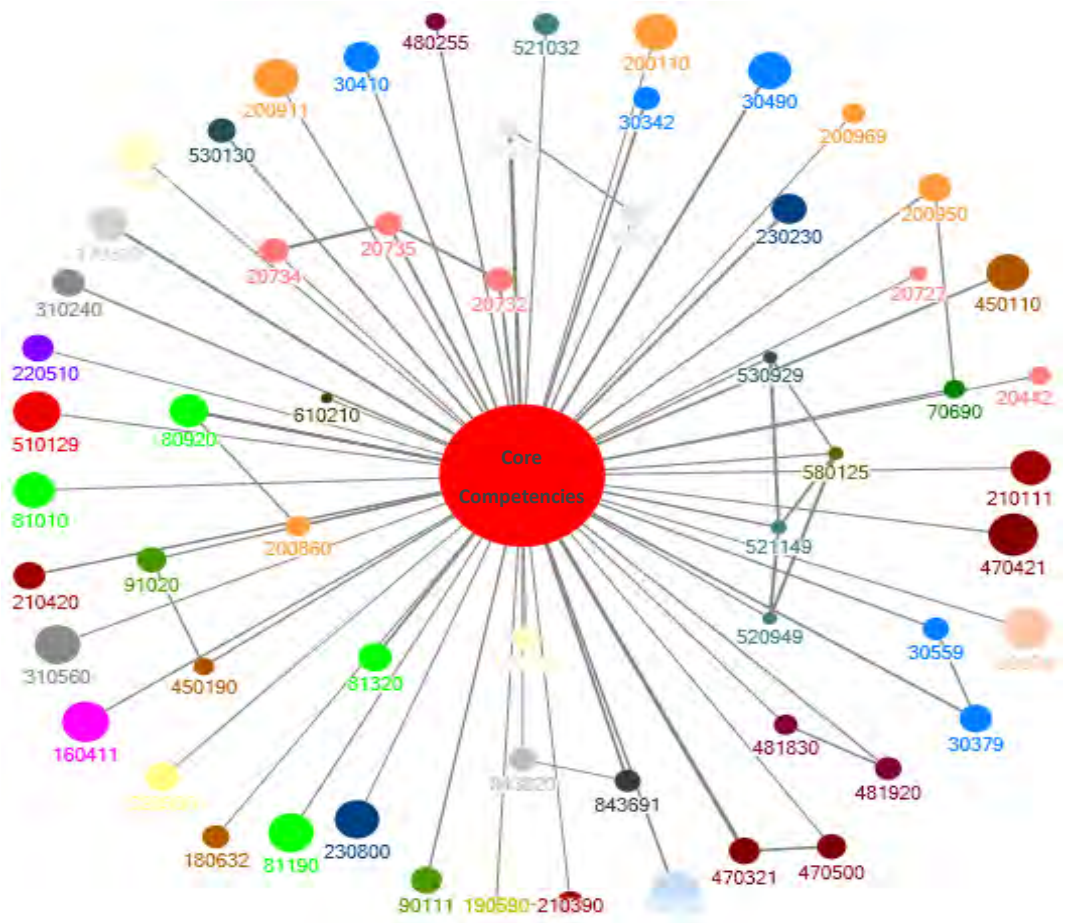


Figure 6.48: Human capital opportunity value in South Africa's opportunity network of its core competencies in the agro-complex

Source: Author's own calculations (2013)

Figure 6.48 indicates that a relatively large proportion of the 60 diversification opportunities stemming from the country's core competencies have a relatively high human capital intensity. These specific opportunities form a first-round scope for developing human

capital in the agro-complex. The average *Human capital opportunity value* of these specific opportunities is 4.6. This is higher than the average value for the diversification opportunities stemming from South Africa's overall productive structure, which is at 4.0. These 217 diversification opportunities and the proportion of their respective *Human capital opportunity values* are shown in Figure 6.49 below.

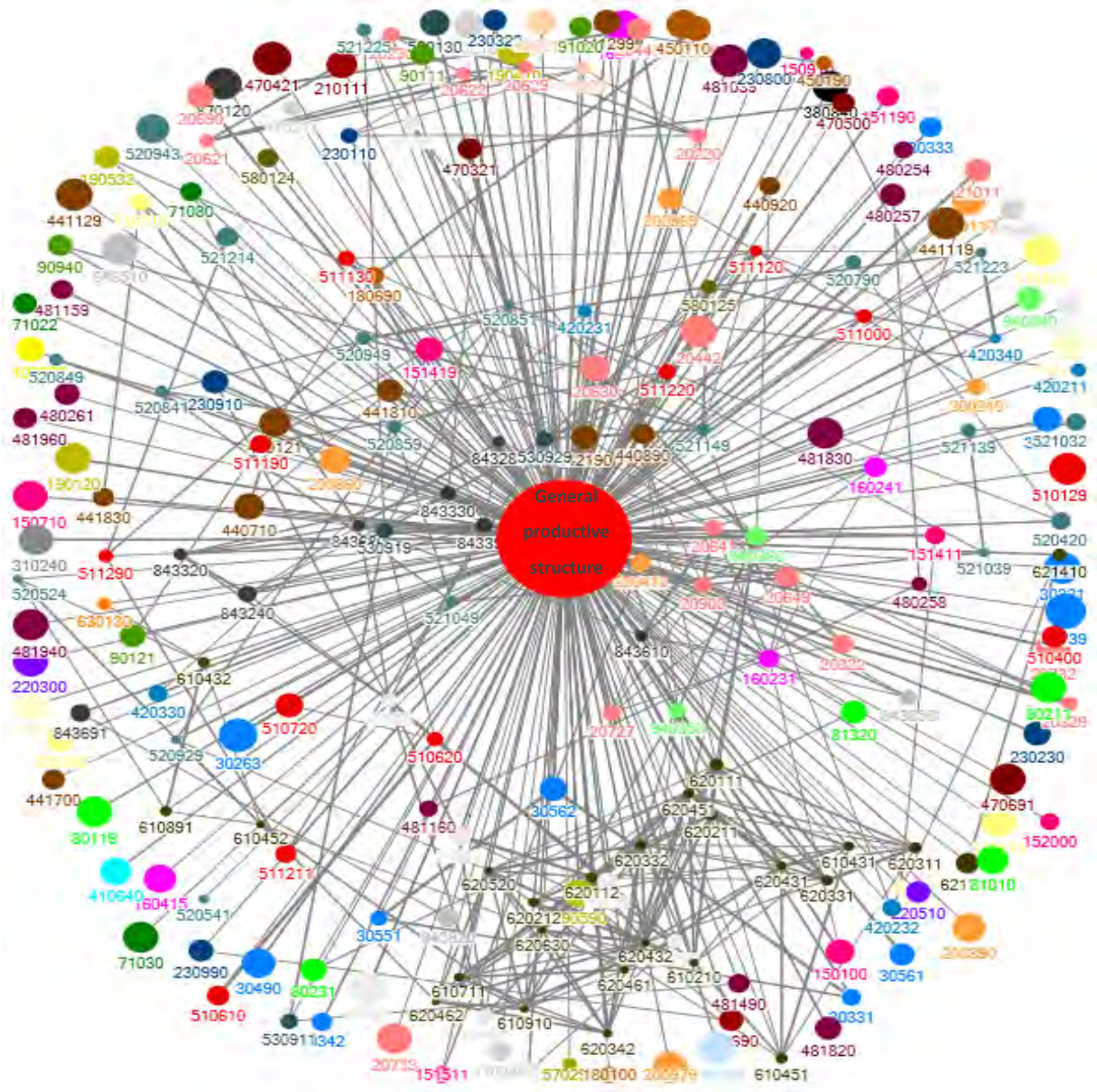


Figure 6.49: Human capital value in South Africa's opportunity network of its overall productive structure in the agro-complex

Source: Author's own calculations (2013)

A summary of the human capital intensities of South Africa's diversification opportunities in the five respective clusters of the agro-complex is provided in Figure 6.50 below. The average *Human capital opportunity value* for each cluster is plotted on the y-axis against the average *Distance* of each cluster to the country's current productive structure. The size of the bubbles is proportional to the number of diversification opportunities in each of the five clusters.

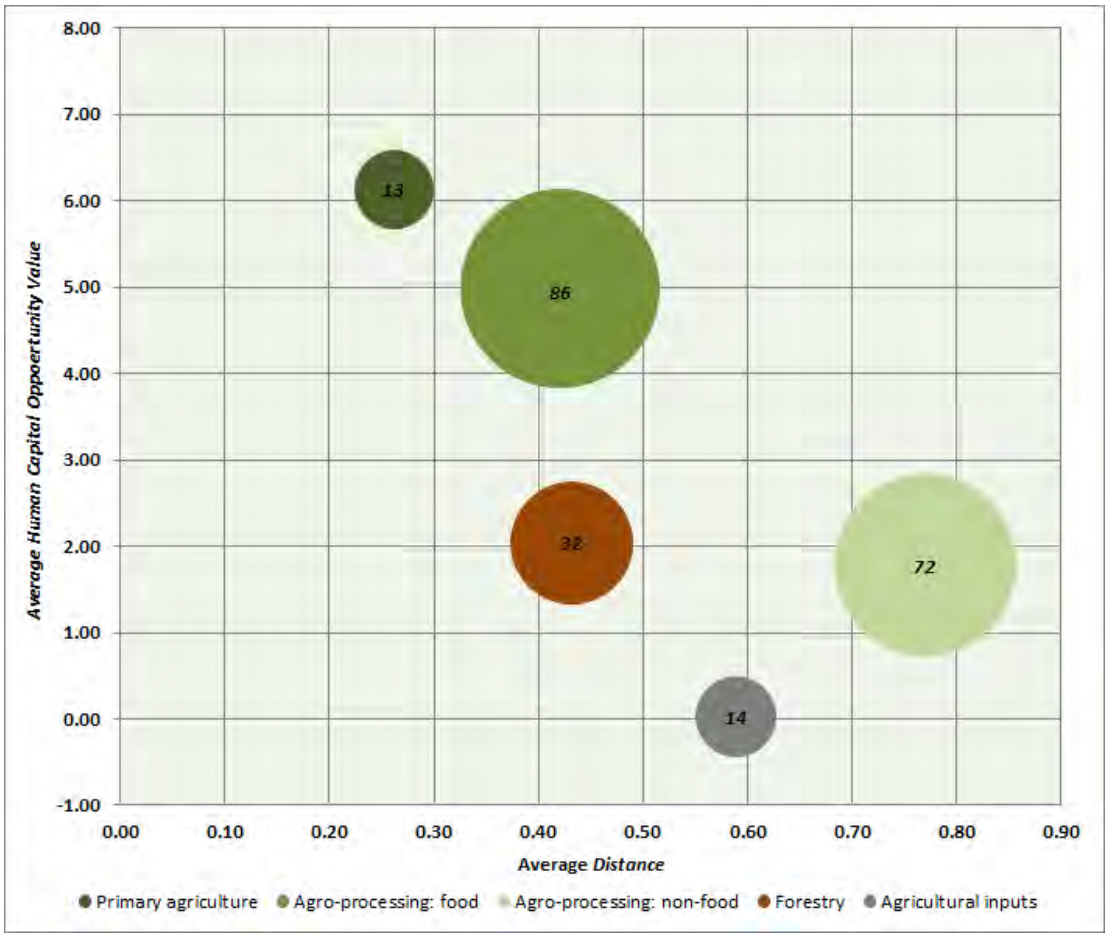


Figure 6.50: South Africa's diversification spectrum for human capital intensity in the agricultural product space

Source: Author's own calculations (2013)

It is evident from Figure 6.50 that the largest scope for developing human capital can be derived from diversification within primary agriculture. However, the total number of diversification opportunities in this cluster is low. Another cluster with a relatively large

scope for human capital development is agro-processing of food. Furthermore, this cluster holds a relatively large number of diversification opportunities.

The other three clusters present less scope for human capital development. The level of human capital intensity of the diversification opportunities in those clusters is likely to be more on par with South Africa's human capital endowment. Hence, diversifying within these clusters will put less strain on human capital and ensure the sustainability of diversification ventures in the short-term. Since developing the quality dimension of labour in the agro-complex is crucial for structural transformation, the long-term scope for diversification should be focused on those products with high levels of human capital intensity.

Comparing Figure 6.41, showing the *Employment opportunity value*, and Figure 6.50, it becomes evident that only the diversification opportunities in primary agriculture hold equal prospects for increasing employment and human capital. Moreover, the agro-processing of food cluster holds significantly more favourable prospects for human capital development than for employment creation. From both figures, it is apparent that the other clusters have relatively low prospects for both the quantitative and qualitative dimensions of employment.

The top diversification opportunities within South Africa's agro-complex that have the highest potential for developing human capital are shown in Tables 6.19 and 6.20 below. The opportunities are ranked according to their *Human capital opportunity value* (see fifth column) which reflects the human capital intensity, weighted by the distance of the product to the South Africa's current core competencies in the agricultural product space. The level of human capital intensity of the opportunities is indicated in the sixth column, which is classified according to the human capital intensity of all products in the agro-complex. It is clear from both these tables that all of these opportunities have higher human capital intensity than South Africa's endowment, which can put a strain on the sustainability of these potential diversification ventures in the short- to medium-term.

Table 6.19 shows specifically the opportunities stemming from South Africa's core competencies. These opportunities are attainable in the short-term, as the country already

has well-developed capabilities in current production to which these diversification opportunities are linked. Furthermore, the opportunities in this table include some products already produced by South Africa, but with a low level of specialisation (highlighted in bold). Hence, building stronger linkages with these products will further enhance their development. Table 6.19 shows that most of the top opportunities for human capital development are located within the agro-processing of food cluster.

Table 6.19: South Africa's top 10 diversification opportunities from its core competencies with high potential for human capital development

#	HS	Product	Cluster *	Human capital opportunity value	Human capital intensity	Position to SA's human capital endowment
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	470421	Chemical wood pulp, sulphite, other than dissolving grades, semi-bleached/b	FO	10.76	High	Higher
2	430160	Raw furskins, of fox, whole, with/without head/tail/paws	AF	10.48	High	Higher
3	***50800***	***Coral & sim. mats.; shells of molluscs/crustaceans/echinoderms & cuttle-bon ...***	***AN***	***10.22***	***High***	***Higher***
4	510129	Wool, not carded/combed, degreased, not carbonised, other than shorn	PA	9.78	High	Higher
5	160411	Salmon, prepd./presvd., whole/in pieces (excl. minced)	AF	9.70	High	Higher
6	***310560***	***Mineral/chem. fertilisers cont. the 2 fertilising elements phosphorus***	***AI***	***9.11***	***High***	***Higher***
7	***81190***	***Fruit & nuts, n.e.s., uncooked / cooked by steaming / boiling in water, frozen, ...***	***AF***	***9.01***	***High***	***Higher***
8	***200911***	***Orange juice, frozen, unfermented & not cont. added spirit, whether***	***AF***	***8.88***	***Medium***	***Higher***
9	230800	Vegetable mats./waste/residues/by-prods., whether or not in pellets, of a	AF	8.69	Medium	Higher
10	120600	Sunflower seeds, whether or not broken	PA	8.35	Medium	Higher

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs.

Source: Author's own calculations (2013)

Table 6.20 below elaborates on the previous table by taking South Africa's overall productive structure in the agro-complex as a basis for diversification. The dominance of the

agro-processing of food and the forestry clusters in this top 10 is yet again evident. None of the opportunities in Table 6.20 are currently produced by South Africa. Furthermore, not all existing production capabilities in this general productive structure may be as well-developed as in the country's core competencies. This may imply that some diversification opportunities are more difficult to realise. Therefore, the opportunities originating from the country's core competencies are highlighted in bold.

Table 6.20: South Africa's top 10 diversification opportunities from its general productive structure with high potential for human capital development

#	HS	Product	Cluster *	Human capital opportunity value	Human capital intensity	Position to SA's human capital endowment
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	030739	Mussels (Mytilus spp., Perna spp.), other than live/fresh/chilled	AF	11.95	High	Higher
2	030263	Coalfish (Pollachius virens), fresh/chilled (excl. fillets/oth. fish	AF	10.80	High	Higher
3	**470421**	**Chemical wood pulp, sulphite, other than dissolving grades, semi-bleached/b ...**	**FO**	**10.76**	**High**	**Higher**
4	**430160**	**Raw furskins, of fox, whole, with/without head/tail/paws**	**AN**	**10.48**	**High**	**Higher**
5	481039	Kraft paper & paperboard other than that of a kind used for writing/printing	FO	10.14	High	Higher
6	441129	Fibreboard of wood/oth. ligneous mats., whether or not bonded with resins/o ...	FO	9.94	High	Higher
7	110422	Oats, worked othw. than by rolling (e.g., hulled/pearled/sliced/kibbled)	AF	9.89	High	Higher
8	030321	Trout (Salmo trutta, Oncorhynchus mykiss/clarki/aguabonita/gilae/apache/chr ...	AF	9.79	High	Higher
9	441119	Fibreboard of wood/oth. ligneous mats., whether or not bonded with resins/o ...	FO	9.78	High	Higher
10	**510129**	**Wool, not carded/combed, degreased, not carbonised, other than shorn**	**PA**	**9.78**	**High**	**Higher**

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs

Source: Author's own calculations (2013)

A comprehensive overview of the potential for human capital development of all diversification opportunities stemming from South Africa's general productive structure in the agro-complex is provided in Data Supplement X. The diversification opportunities with links to South Africa's core competencies are marked in bold.

The sustainability in terms of human capital of the 217 diversification opportunities depicted in Data Supplement X is dependent on their relative intensity levels compared to South Africa's current endowment (last column). Therefore, the share of opportunities with higher human capital intensities than the level of endowment is distributed as follows:

- Primary agriculture: 70 per cent
- Agro-processing of food: 79 per cent
- Agro-processing of non-food: 44 per cent
- Forestry: 91 per cent
- Agricultural inputs: 100 per cent.

From this it is evident that the agro-processing of non-food cluster has the largest proportion (56 per cent) of opportunities, with human capital intensities that are on par with the country's human capital endowment. Primary agriculture has the second largest proportion of opportunities, with human capital intensities below the country's endowment level. The sustainability of most diversification opportunities in the three other clusters is severely under strain, since a large proportion of these opportunities have a human capital intensity above the human capital endowment of South Africa.

6.6 CONSOLIDATION OF DIVERSIFICATION PATHWAYS

The previous sections have analysed the different pathways for diversifying South Africa's agro-complex, based on three strategic values, namely structural transformation (Section 6.3), market potential (Section 6.4), and employment (Section 6.5). The initial potential for diversification within the framework of the agricultural product space is determined by the "new" product's *proximity* to the existing production. Furthermore, its relatedness to either

a core competency or a product in which the country has a relatively low level of specialisation is also of importance. Diversification pathways stemming from a core competency are deemed easier to achieve, as their capabilities are further developed and thus easier to transfer to new production ventures.

The decision on which of the three strategic values is to be 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, whereas 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 choice.

To analyse the relationship between the three strategic values, a Pearson correlation analysis is conducted on the underlying indicators[47]. The results are shown in Table 6.21 below. It is evident from the table that a statistically significant but negative relationship exists between product complexity and export potential, although the strength of the correlation is relatively weak. Hence, the more complex products generally face a smaller international market demand than less complex products do. It is likely that the latter are agricultural bulk commodities, whereas the former consists of specialised niche products. The table also indicates a statistically significant and negative relationship between product complexity and labour intensity. This relationship is also relatively weak, though. This result likely implies that the more complex products are capital intensive, rather than labour intensive. Finally, the results reveal that no statistically significant relationships exist 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.

[47] For market demand, the single indicator of total potential export value, as determined by the DSM, is used, and not taking the other three channels for market-driven diversification, as discussed in Section 6.2 into account.

Table 6.21: Pearson correlation analysis for the strategic values of diversification opportunities

	Product complexity	Export potential	Labour intensity
Product complexity	1	-0.202**	-0.204**
Export potential	-0.202**	1	-0.83
Labour intensity	-0.204**	-0.83	1

Note: ** correlation is significant at the 0.01 level

Source: Author's own calculations (2014)

In an attempt to provide some guidance and suggest priority for diversification endeavours and strategies in South Africa's agro-complex, a *Consolidated strategic value* was calculated for each diversification opportunity. This is done by calculating a standardised score[48] for each of the three indicators and simply summing them. This thus allocates an equal weight to each of the three strategic values. The top 15 diversification opportunities, based on all three strategic values, are shown in Table 6.22 below. Column five of the table indicates the distance of the opportunity to South Africa's current production in the agricultural product space. It is evident from Table 6.22 that 7 of the top 15 ranked diversification opportunities fall within the forestry cluster. Considering the top 25 per cent of products with the highest *Consolidated strategic value,* products from the forestry cluster also come out strong, followed by agro-processing of food and primary agriculture.

Table 6.22: Top 15 diversification opportunities based on the three strategic values

#	HS	Product	Cluster *	Distance to SA's current production	Consolidated Strategic Value
(1)	(2)	(3)	(4)	(5)	(6)
1	440710	Wood sawn/chipped length wise, sliced/peeled, whether or not planed, sanded ...	FO	0.34	6.31
2	90940	Seeds of caraway	PA	0.50	5.54
3	940360	Wooden furniture (excl. of 94.01 & 9403.30-9403.50)	FO	0.67	5.41
4	80231	Walnuts, in shell	PA	0.51	5.32
5	80211	Almonds, in shell	PA	0.00	4.81
6	470321	Chemical wood pulp, soda/sulphate, other than dissolving grades, semi-bleac ...	FO	0.61	4.76

[48] Standardised score = $\frac{X-\mu}{\sigma}$

(Table 6.22 continued)

#	HS	Product	Cluster *	Distance to SA's current production	Consolidated Strategic Value
(1)	(2)	(3)	(4)	(5)	(6)
7	**610910**	**T-shirts, singlets & oth. vests, knitted or crocheted, of cotton**	**AN**	**0.97**	**4.26**
8	091020	Saffron	PA	0.50	4.14
9	620342	Men's/boys' trousers, bib & brace overalls, breeches & shorts (excl. swimwe ...	AN	0.94	3.40
10	620462	Women's/girls', trousers, bib & brace overalls, breeches & shorts (excl. sw ...	AN	0.97	3.16
11	940350	Wooden furniture of a kind used in the bedroom	FO	0.75	2.70
12	441119	Fibreboard of wood/oth. ligneous mats., whether or not bonded with resins/o ...	FO	0.00	2.61
13	440121	Wood, in chips/particles, coniferous	FO	0.33	2.50
14	440920	Wood (incl. strips & friezes for parquet flooring, not assembled) continuou ...	FO	0.59	2.29
15	020329	Meat of swine (excl. carcasses/half-carcasses/hams/shoulders & cuts thereof ...	AF	0.80	2.06

* PA = Primary agriculture, FO = Forestry, AF = Agro-processing: Food, AN = Agro-processing: Non-food, FO = Forestry, AI = Agricultural Inputs

Source: Author's own calculations (2014)

The performance of the five clusters in terms of the consolidation of the three strategic values is further illustrated in Figure 6.51 below. The figure shows the distribution of the *Consolidated strategic value* within each of the five clusters. It is evident that, overall, the primary agriculture and forestry clusters show the best prospects for either: structural transformation, market demand or employment. The agro-processing of food cluster, which features high on South Africa's industrialisation agenda (e.g. IPAP), shows the worst prospects overall. However, these are generalised results and cognisance should be taken of the ranking of individual products, which should be the point of departure for diversification strategies in the agro-complex (see Section 7.5). Hence, a comprehensive ranking based on the *Consolidated strategic value* of all 217 diversification opportunities is provided in Data Supplement XI.

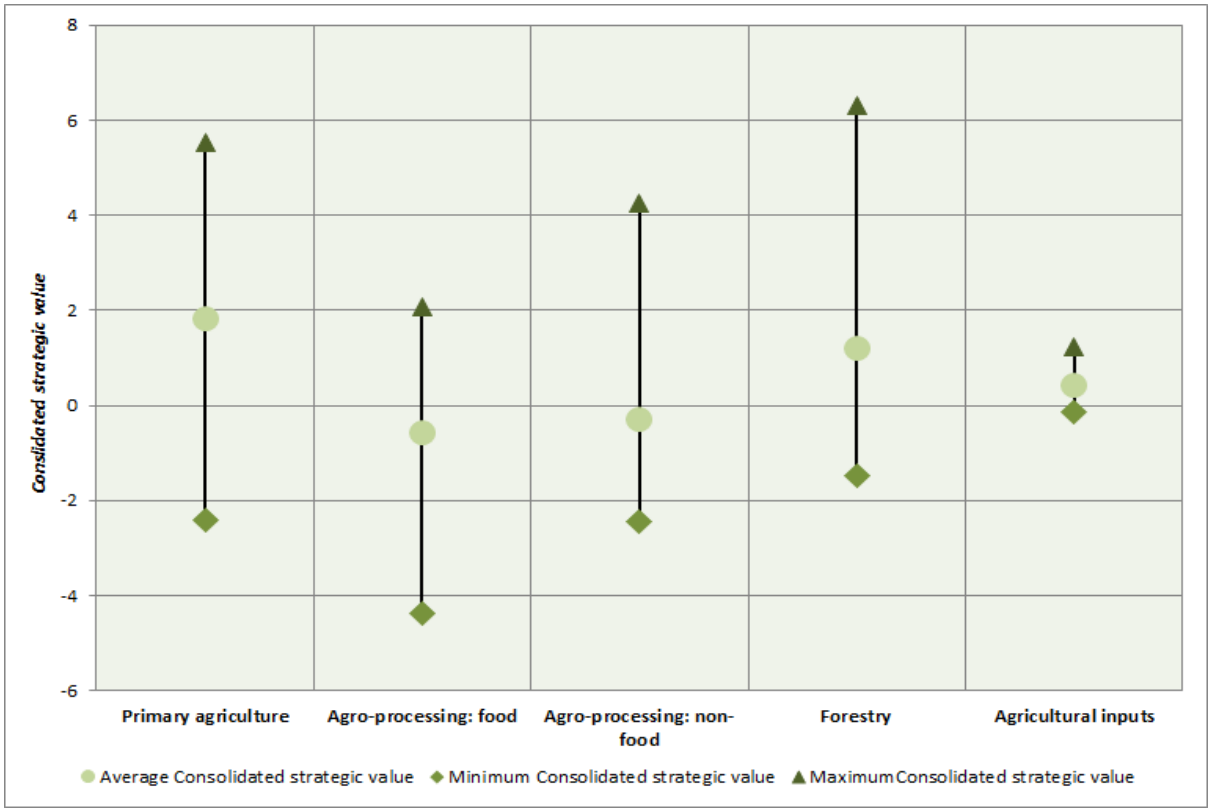


Figure 6.51: Distribution of South Africa's consolidated strategic value per cluster
Source: Author's own calculations (2014)

The next chapter (seven) provides a summary of this study, as well as an overview of the main outcomes, and concludes with recommendations.