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Economic complexity and development: Strategies for the structural diversification of the Moroccan economy



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Work team:
Anass SAIDI

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Introduction

Morocco has managed, from the beginning of the 2000s, to accelerate the growth rate of its per capita income and to improve its economic specialization profile thanks to the emergence of new industries with high potential. However, the potential of this transformative momentum is far from being fully mobilized. Even though the pace of growth of the Moroccan economy is increasing, it remains globally insufficient to allow an accelerated convergence of Morocco towards the income levels of developed and emerging countries.

Recent developments in the theoretical and empirical concept of economic complexity have opened up new opportunities to study the process of economic development as a process of structural transformation. This line of research has led to the development of a set of measures, including the Economic Complexity Index, which measures the productive capabilities a company mobilizes. Recent empirical work has shown that differences in development between countries can be explained by differences in economic complexity.

Given its interest in structural issues with a strong impact on the development trajectory of our country, the Department of Economic Studies and Financial Forecast (DEPF) has deemed it useful to examine in depth the process of structural transformation of the Moroccan economy in the light of the concept of economic complexity.

After a brief reminder of Morocco's efforts to reinforce the foundations of a modern and competitive economy, the analysis will focus on understanding the concept of economic complexity and its application in the Moroccan context. The purpose of this analytical exercise is to identify the factors that prevent the Moroccan economy from making an important qualitative leap allowing it to accelerate the pace of economic convergence. To cope with the constraints in this area, some key instruments have been identified that could prove useful in putting the Moroccan economy on a strong and sustained growth path.

1. CONVERGENCE AND STRUCTURAL TRANSFORMATION OF THE NATIONAL ECONOMY: A FEW REFERENCE POINTS

Morocco's economy grew at an average annual rate of 4.2% over the period 1999-2017, resulting in an increase in GDP per capita of 2.9% on average per year. This performance comes after a decade (1990 to 1999) which has experienced a growth rate of 3% per year and a per capita GDP which has increased by only 1.5%.

This overall performance hides, however, contrasting trends. Over the period 1999-2008, GDP grew strongly, reaching 4.8%, while GDP per capita grew by 3.6%. The global crisis, which prevailed from 2008, did not fail to reduce this performance, bringing GDP growth and per capita GDP growth to a more moderate pace, averaging 3.7% and 2.5% respectively over the 2008-2017 period.

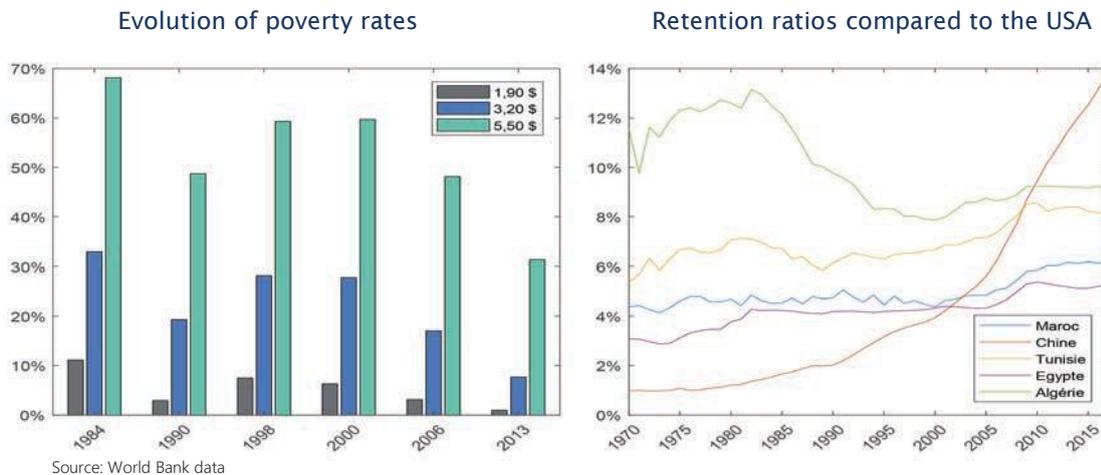
The strong development of growth in economic activity has led to positive effects in terms of improving the living conditions of Moroccans. As proof, the population living below the poverty line at \$ 1.9 a day¹ dropped from 7.5% in 1998 to 1% in 2013, according to data from the World Bank. This implies that extreme poverty is being eradicated in Morocco. Similarly, the poverty rates of \$ 3.20 and \$ 5.50 a day fell significantly from 17% and 59.3% in 1998 to 7.7% and 31.3% in 2013.

The growth momentum remained, during the last two decades, fairly strong to allow a gradual reduction of poverty. However, it has not been fast enough to put the Moroccan economy on the path of economic convergence. In fact, the ratio of Morocco's GDP per capita (in constant dollars) to that of the United States rose by just under 2 percentage points between 1970 and 2017, from 4.4% to 6.2%. During the same period, the same ratio went from 1% to 13.8% for China and 7.8% to 49.2% for South Korea.

Examining the process of structural transformation of the Moroccan economy makes it possible to better understand the factors behind the slow convergence. The evolution of employment shares by sector (despite the limits of this measure) shows a relative stagnation of the productive structure of the Moroccan economy. The share of agricultural employment in total employment fell by 4 percentage points between 1991 and 2018 to 37% (Graph 2). For a country like China, which is engaged in a process of accelerated convergence, the share of agricultural employment has fallen by almost 40 percentage points, from 55% to 16% of the employed labor force. Similarly, the Vietnamese economy, whose structural transformation is more recent, employed three-quarters of its active labor force in the agricultural sector in 1991. In 2018, this share reached 40% following a rapid evolution of employment in the industrial (9% to 25%) and services sectors (16% to 35%).

¹ Ratio of the poor population with less than \$ 1.90 per day (2011 PPP) (% of population).

Graph 1: Trends in poverty rates and relative GDP per capita



In another development, Morocco's export structure, albeit with relative improvement; shows a mixed evolution, with both decreasing and increasing trends. The share of medium-technology manufactures has risen sharply from 9% in 2000 to 36% in 2016. This change is mainly due to the increase in the share of motor vehicles, which account for nearly 10% of exports in 2016, while this share was almost zero in 2000. The same goes for electric cables whose share has increased from 2% in 2000 to more than 10% in 2016.

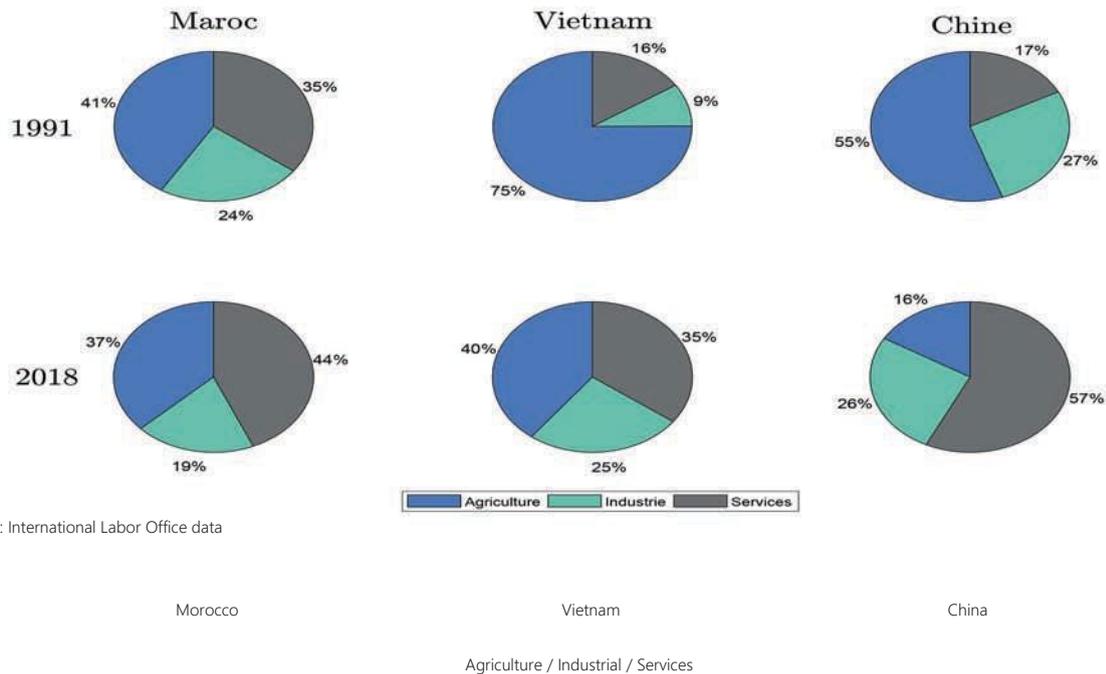
However, such a development has occurred at the expense of low-tech manufactures. In fact, the new positioning acquired by Morocco has not been accompanied by a greater diversification of Moroccan exports. In 2016, Morocco had a revealed comparative advantage² for 122 products on a nomenclature that has 786³ compared to 117 products in 2000. The gain in new positioning (38 products) was accompanied by a loss of positioning in other segments (33 products).

The acceleration of the pace of economic convergence in Morocco is all the more necessary as our country faces significant social challenges. The economic growth rates achieved in the early 2000s initially made it possible to ease pressures on the labor market. The unemployment rate dropped to its all-time low in 2011 to 8.9%, down 4.9 percentage points from 1999. However, since 2012, the unemployment rate has been on an upward trend, crossing the 10% mark in 2017 before returning to 9.8% in 2018.

² Balassa (1965).

³ Standard international trade classification (SITC) Rev 2 at 4 digit level.

Graph 2: Structure of the employed labor force by sector (in %)



Source: International Labor Office data

Furthermore, unemployment is severely affecting some segments of the labor force. In 2017, unemployment among young people aged 15 to 24 was 26% at the national level and 43% in urban area. The breakdown of unemployment by level of education shows that it affects particularly holders of middle and higher level degrees with respective shares of 15% and 23%. On the other hand, unemployment affects only 3.8% of the active population without a degree.

Taking all of the above into account, improving the standard of living of Moroccans and reducing the level of unemployment are two major challenges that Morocco must address. In order to create the right conditions to better meet these challenges, providing impetus to the process of structural transformation of the Moroccan economy is therefore necessary. This impetus would be useful in diversifying the sources of national wealth creation and maximizing its social and territorial benefits.

2. ECONOMIC COMPLEXITY: CONCEPT AND MEASURE

2.1. CONCEPT AND MEASURES OF ECONOMIC COMPLEXITY

Following a series of works, in particular Hidalgo and al. (2007) and Hidalgo & Hausmann (2009), the last decade has seen the development and refinement of empirical methods for quantifying economic complexity. According to the same authors⁴, this concept can be traced back to Adam Smith. The latter attributes the origin of economic development to the division of labor. In their reinterpretation of this Hausmann concept, Hidalgo, and al. (2014) suggest that the division of labor gives everyone access to more knowledge than a single individual can acquire. Economic complexity can be defined as a measure of how much knowledge a society mobilizes. This definition implies that economic complexity jointly measures two phenomena:

- The first one has to do with the accumulation of knowledge, by a society, by distributing a tiny part to each individual. This amount of knowledge does not increase by expanding the same knowledge among several individuals, but through diversification in regard to society or through specialization in regard to individuals.

⁴ Hidalgo & Hausmann (2009) and Hausmann, Hidalgo, and al. (2014).

- The second phenomenon concerns the ability of this society to mobilize this knowledge. This would imply that the amount of knowledge actually mobilized depends on the quality of the institutions implemented by society to ensure the cooperation of its members, whether they are organizations or markets.

This concept has been the key to analyzing economic development since the advent of economic science. Its measure has, however, remained elusive. To overcome this limitation, Hidalgo & Hausmann (2009) assumes that each country produces products that the knowledge within the individuals and organizations that make it up allows it to produce. Some products require a great diversity of knowledge and organizations maintaining a wide network of interactions (computer processors, jet engines, etc.) others are less demanding (raw natural resources). This study allows authors to suggest a measure of economic complexity by studying the product range that countries are capable of producing.

The diversity of the export basket is a summary measure of a country's productive capacity. Similarly, product ubiquity (the number of countries exporting it) is a summary measure of the difficulty of producing it. The limits of each measure are obvious. In the first case, two countries can export the same number of products, but of very different natures. The second measure suffers from the existence of certain products that few countries export, but whose low ubiquity cannot be explained by a specific knowledge, but by geology or climate.

The method developed by Hausmann, Hidalgo, and al. (2014), called reflections, allows to correct the information contained in each of the two measurements by using the other. For a country, it consists of iteratively calculating the average ubiquity of the products it exports and the average diversity of countries exporting these products. Similarly, measuring the complexity of a given product consists of calculating the average diversity of countries exporting the product and the average ubiquity of the other products that these countries export (Box 1.1).

This method relies on international trade data due to the unavailability of detailed and consistent data on each country's product range. However, there are two main issues with these data. The first is the possibility that a country produces a good without exporting it. Inability to export a product is interpreted as a sign of low productivity or quality and therefore implies a lack of productive knowledge. Conversely, the second issue is that a country may re-export goods that it does not produce. In this case, only products for which a country has sufficient comparative advantage are considered.

Box 1.1: Calculation of the Economic Complexity Index

The calculation of the economic complexity index is based on the matrix M_{cp} which is given for a country c and a product p by:

$$M_{cp} = \begin{cases} 1 & \text{si } RCA_{cp} \geq 1 \\ 0 & \text{sinon} \end{cases}$$

RCA refers to the revealed comparative advantage of a country over a given product defined by Balassa (1965) as follows:

$$RCA_{cp} = \frac{\frac{X_{cp}}{\sum_c X_{cp}}}{\frac{\sum_p X_{cp}}{\sum_{c,p} X_{cp}}}$$

From the M_{cp} matrix Hausmann, Hidalgo, and al. (2014) define a recursion to calculate the economic complexity index:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} \cdot k_{p,N-1} \quad k_{p,N} = \frac{1}{k_{p,0}} \sum_c M_{cp} \cdot k_{c,N-1}$$

The recursion starts with the calculation of two indicators:

$$\text{Diversité} = k_{c,0} = \sum_p M_{cp} \quad \text{Ubiquité} = k_{p,0} = \sum_c M_{cp}$$

Intuitively, the economic complexity index is a measure that is based on the reciprocal correction of the information contained in the diversification of countries and the ubiquity of products.

By stating :

$$\tilde{M}_{cc'} = \sum_p \frac{M_{cp} M_{c'p}}{k_{c,0} k_{p,0}}$$

The recursion satisfies the equation, $k_{c,N} = \sum_{c'} \tilde{M}_{cc'} k_{c',N-2}$, which is satisfied by, $k_{c,N} = k_{c,N-2} = 1$

The solution corresponds to the eigenvector of $\tilde{M}_{cc'}$ associated with the greatest eigenvalue. Since this vector is a vector of 1, the ECI is calculated on the basis of the eigenvector \vec{K} associated with the second eigenvalue and then centered and reduced:

$$ECI = \frac{\vec{K} - \langle \vec{K} \rangle}{stdev(\vec{K})}$$

The product complexity index (**PCI**) is calculated by transposing the matrices, with \vec{Q} the eigenvector associated with the second eigenvalue of the $\tilde{M}_{pp'}$ matrix:

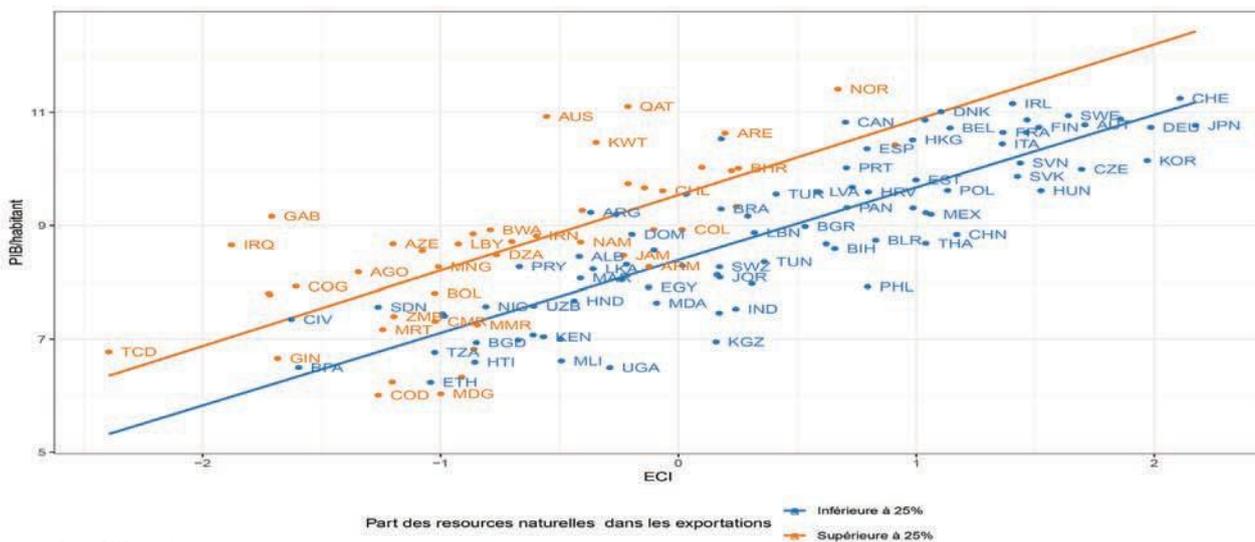
$$PCI = \frac{\vec{Q} - \langle \vec{Q} \rangle}{stdev(\vec{Q})}$$

The economic complexity index, calculated in this way, makes it possible to rank countries according to the level of complexity as revealed by their export baskets. The index, however, has no absolute quantitative interpretation. It is a standard normal distribution variable for each year and therefore represents a relative measure. The historical variation of the index corresponds to the change in the ranking of countries.

The value of this index is seen when it is correlated with the level of development as measured by GDP per capita. The higher the level of economic complexity in a country, the more likely it is to have a high income level (Graph 3).

Bear in mind that the economic complexity index is based only on a count of the products that each country exports and the number of countries exporting each product. It does not include information on GDP per capita or other variables that could induce an endogeneity bias. Regardless of this, the economic complexity index explains 53% of the variance in GDP per capita and 68% when the effect of wealth due to natural resources is eliminated.

Graph 3: Relationship between economic complexity and GDP per capita



Source: DEPF calculations

Shares of natural resources in exports Less than 25%
 Greater than 25%

The ranking of countries by level of complexity is not stable, especially over relatively long periods. The improvement in the level of complexity of some countries has opened up new growth prospects that have often been confirmed. The rapid economic convergence of some countries has been met by an equally rapid rise in their economic complexity ranking. In this regard, China advanced, between 1990 and 2016, from 40th place (out of 107) to the 17th and South Korea reached the 3rd place in 2016 while it was in 19th place in 1990. Other countries, which were at the bottom of the rankings in 1990, have made spectacular breakthroughs. Vietnam and Uganda, in particular, advanced respectively from 93rd and 101st to 47th place and 61st. Morocco, for its part, has seen a slight increase in its ranking under the economic complexity index, from 69th to 65th.

Table 1: Estimate of the relationship between GDP per capita and the economic complexity index

Explained Variance	Average annual growth of GDP per capita (1976 - 1986, 1986 - 1996, 1996 - 2006, 2006 - 2016)			
	Estimate	Standard error	Student-t	Student t-test
Constant	0,090	0,009	10,130	0,000
ECI	0,031	0,007	4,175	0,000
Initial GDP per capita	-0,010	0,001	-9,560	0,000
Natural resources	0,053	0,010	5,438	0,000
ECI* GDP /hab	-0,002	0,001	-2,262	0,024
Fixed effects periods				
R2	0,294			
R2 adjusted	0,282			
Observations	438			

Source: DEPF calculations

2.2. ECONOMIC COMPLEXITY OF MOROCCO

In this study, the calculation of the different complexity indices is based on the data developed by the Center for International Development at Harvard, from raw data on international trade (COMTRADE) processed according to the Bustos-Yildirim method. Subsequently, the data was filtered, with 2016 as the reference year according to three criteria⁵, keeping:

- Countries with a population of at least 1.25 million people;
- Countries with total exports of at least \$ 1 billion;
- Products with a global trade of at least \$ 10 million.

The calculation of the different complexity indices (Table 2) shows that each index corresponds to a different classification of countries according to the level of detail of the products used. However, comparing the rankings according to the Economic Complexity Index (ECI) provides a general idea.

The Moroccan economy ranks between the 6th and the 8th decile and more frequently around the 7th according to the method used. This ranking tends to remain stable over time. In fact, Morocco was, according to the index of economic complexity, at the 65th percentile in 1990 and in 2016, while it experienced a significant decrease in its ranking during the 1990s with a low ranking at the 77th percentile in 1995. The stable ranking shows that the complexity of the Moroccan economy is evolving at the same rate as the average global complexity.

⁵ Hausmann, Hidalgo, and al. (2014).

Table 2: Morocco ranking according to different methods and classifications

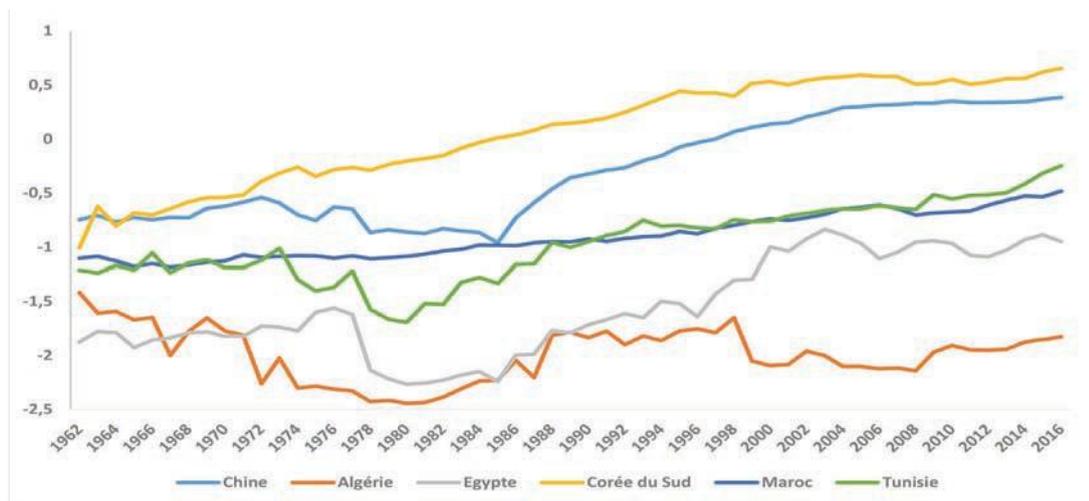
Year 2016, 131 countries	Method			
	ECI	ECI+	FCI-Extensive	FCI-Intensive
Nomenclature				
CTCI Rev.2, 4 digits (773 products)	84	79	69	75
SH 2002, 4 digits (1214 products)	95	84	73	84
SH 2002, 6 digits (4575 products)	103	75	62	65
Atlas of economic complexity	82/127			
Observatory of economic complexity	96/125			

Source: CID-Havard, DEPF calculations

The historical evolution of Morocco's economic complexity⁶ is estimated in this work on the basis of the weighted average of the complexity of the export basket, with the product complexity index for 2016 as a reference point.

In Morocco's case, the slow pace of its economic convergence process, as evidenced by the moderate structural transformation revealed by the stability of the sectorial employment structure (Graph 2), reflects the insufficient pace of acquisition of new productive capacities.

Graph 4: Comparative evolution of the economic complexity of Morocco



Source: DEPF calculations

The development issue presented in terms of economic complexity implies the need to study the dynamics of the acquisition of productive capacities, which is possible to study through the analysis of product space⁷.

⁶ To interpret this measure as the economic complexity of a country, we have to make two assumptions: productive capacities are of different frequencies within an economy and their frequencies are commensurate with their weight in exports.

⁷ Hausmann, Hidalgo, and al. (2014).

3. PRODUCT SPACE: VISUALIZING THE DEVELOPMENT

3.1. PRODUCT SPACE CONSTRUCTION

The economic complexity index is a holistic measure based on the export basket of each country. The changes in the ranking by level of economic complexity suggest that the productive structures of each country evolve and this is reflected in their export baskets. Hausmann & Klinger (2007) and Hidalgo and al. (2007) hypothesize that the acquisition of new product positioning is not done at random. A country will produce new products that require productive knowledge similar to that which it already has.

These authors deduce that a more or less great distance separates each pair of products. Therefore, two products are as closely related as the productive capacities necessary for their production are similar. The relatedness between two products can be measured by the probability that they are co-exported. A pair of products that are exported by a large number of countries indicates that the productive capacities necessary for their production are likely to be similar. These proximities can be viewed using a graphical representation known as "product space".

Box 2.1: Construction of the product space

The product space is made using the proximity matrix of products φ :

$$\varphi_{p,p'} = \frac{\sum_c M_{cp} M_{cp'}}{\max(k_{p,0}, k_{p',0})}$$

The matrix is then filtered, in order to extract the most significant links, in two stages:

1. Calculate the maximum spanning tree using Kruskal's algorithm (1956);
2. Add 1% of the most important links.

Communities are then detected using the Infomap algorithm of Rosvall and Bergstrom (2008). It allows for the detection of 71 communities which are then grouped manually, taking into account the SITC categories so as to maintain homogeneous communities and to reduce their number.

The visualization uses the Force Atlas algorithm of Bastian, Heyman and Jacomy (2009):

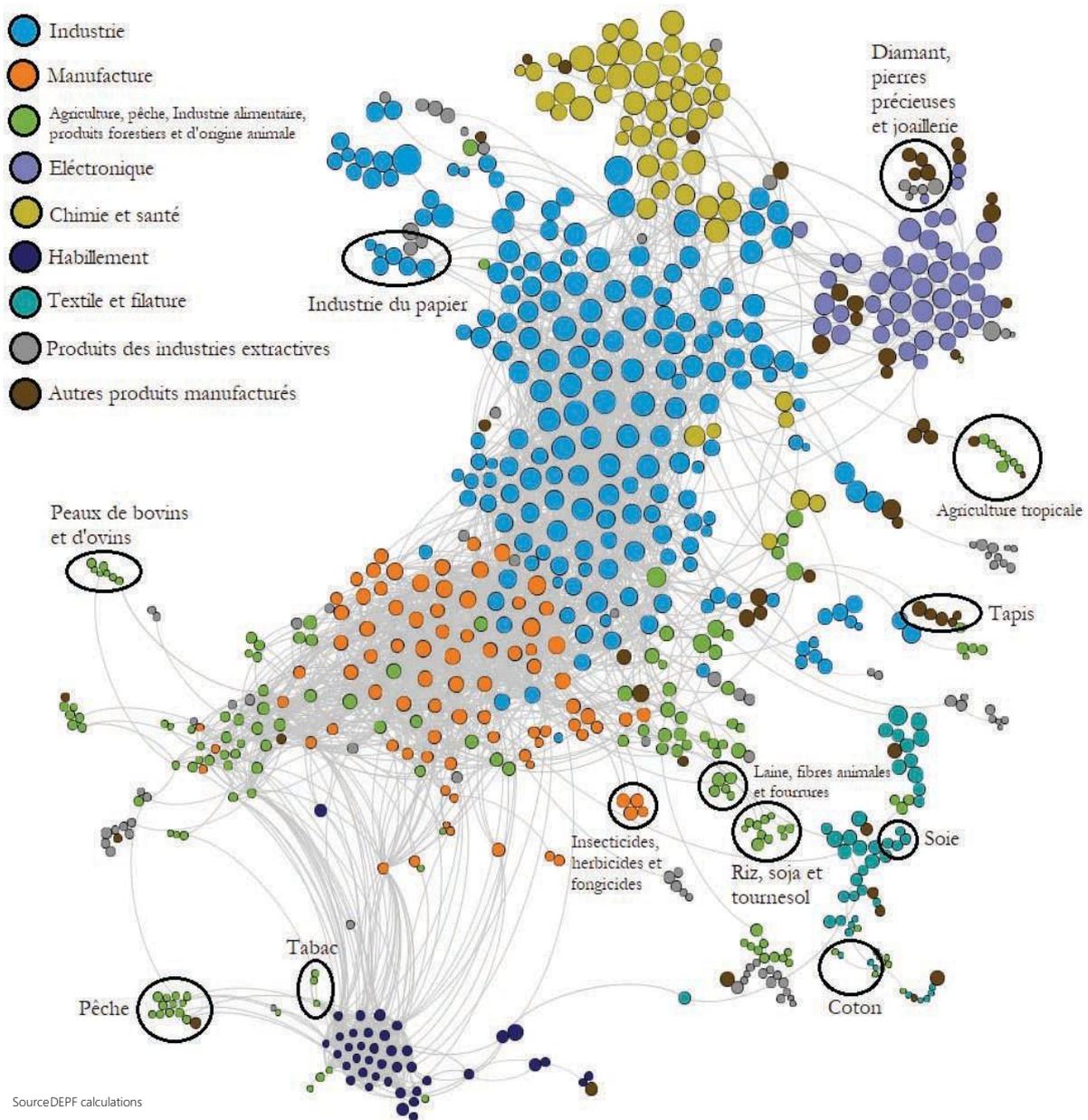
- The nodes are modeled as electrically charged particles;
- The arcs are modeled as springs.

The nodes tend to repel and the arcs to pull them as the force of the arc (proximity between the products); graphically, the products closest to each other tend to agglomerate.

The product space (graph 5) is constructed and viewed by applying the method described in Box 2.1 to trade data from 2012 to 2016. The size of the nodes is proportional (but not linearly) to the complexity of the product. The product space allows for the highlighting of some common aspects. The closer the products are, the more their complexities tend to be similar. A value chain does not necessarily belong to the same community. For instance, radio receivers for motor vehicles (CTCI: 7621) are part of the “electronics” community while the vehicles in question (CTCI: 7810) belong to the “industrial” community.

One of the main conclusions emerging from the use of the product space method is that the path to optimal (or possible) diversification doesn't necessarily mean greater integration within a value chain. It is, in fact, simpler for a country to produce radios for automobiles when it already produces televisions (proximity of 65.8%) than when it produces automobiles (proximity of 33.7%); the products of the second pair do not use a lot of similar productive capacities, unlike the first.

Graph 5: Product space and product communities



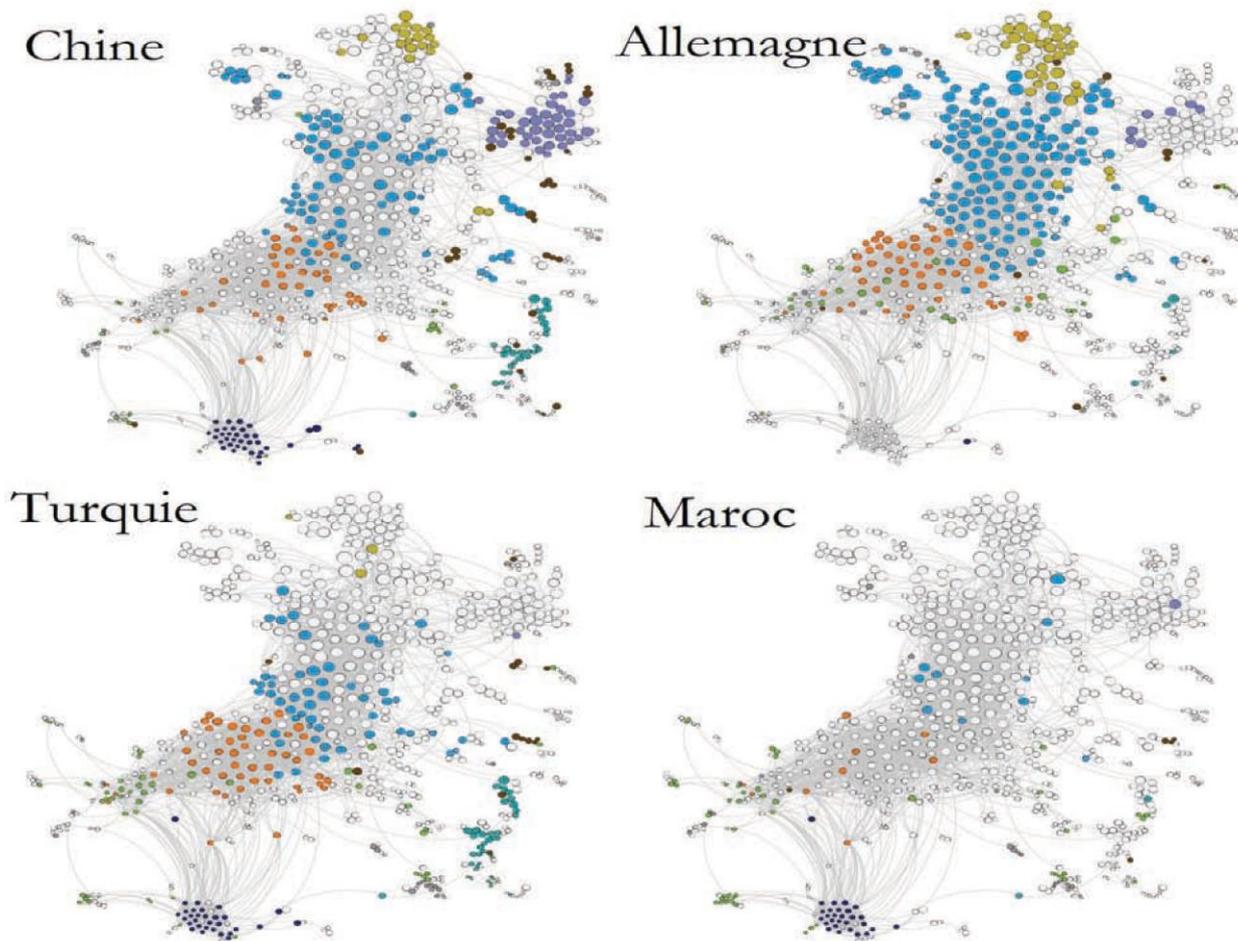
Industrial
 Manufacturing
 Agriculture, Fishing, Food industry, Forestry and animal product
 Electronics
 Chemicals and Health
 Clothing
 Textile and spinning
 Extractive industry products
 Other manufactured products

3.2.PRODUCT SPACE AND ECONOMIC DEVELOPMENT

At different stages of development, countries have more productive capacities that appear through the products that they can export with a comparative advantage. Their structures can be viewed using the product space (graph 3)⁸. The latter shows that a developed country like Germany has a comparative advantage over most industrial, manufacturing and chemical products and is not present in clothing, textiles and electronics⁹. Emerging countries tend to gradually acquire positions in manufacturing, industry and, sometimes, chemicals or electronics, while retaining a comparative advantage over less complex products.

Morocco is positioned on almost all clothing products and also exports certain natural or agricultural products. It has managed, however, thanks to the automotive industry, to acquire a comparative advantage over certain industrial products which can constitute levers for greater diversification of its economy.

Graph 6: Product space of countries at different stages of development



Source: DEPF calculations

China – Germany – Turkey – Morocco

⁸ Products for which the country does not have a revealed comparative advantage greater than 1 are grayed out.

⁹ The distribution of production on global value chains means that these products are produced in less developed countries, although most of the added value (innovation, engineering, marketing, etc.) is often created in more developed countries. One of the limits of the economic complexity index is precisely that it does not take into account trade in services or that of value added, due to the lack of data.

The logic of the product space suggests that each country tends to diversify by moving gradually in this space. This momentum tackles the issue of acquiring new productive capacities. On the one hand, a country can only produce the products for which it has the necessary productive capacities. On the other hand, a country cannot acquire capacities which no industry currently uses. As a consequence, a country diversifies first by producing products which it knows how to manufacture and those which require the acquisition of little new productive knowledge and gradually comes to manufacture products which were initially out of reach.

Box 2.2: Quality of positioning in the product space

The complexity outlook index measures the quality of a country's positioning. Its calculation starts from the proximity matrix between the products:

$$\varphi_{p,p'} = \frac{\sum_c M_{cp} M_{cp'}}{\max(k_{p,0} k_{p',0})}$$

From which we derive the distance between countries and products:

$$d_{c,p} = \frac{\sum_c (1 - M_{cp'}) \varphi_{p,p'}}{\sum_{p'} \varphi_{p,p'}}$$

And then the economic complexity outlook index:

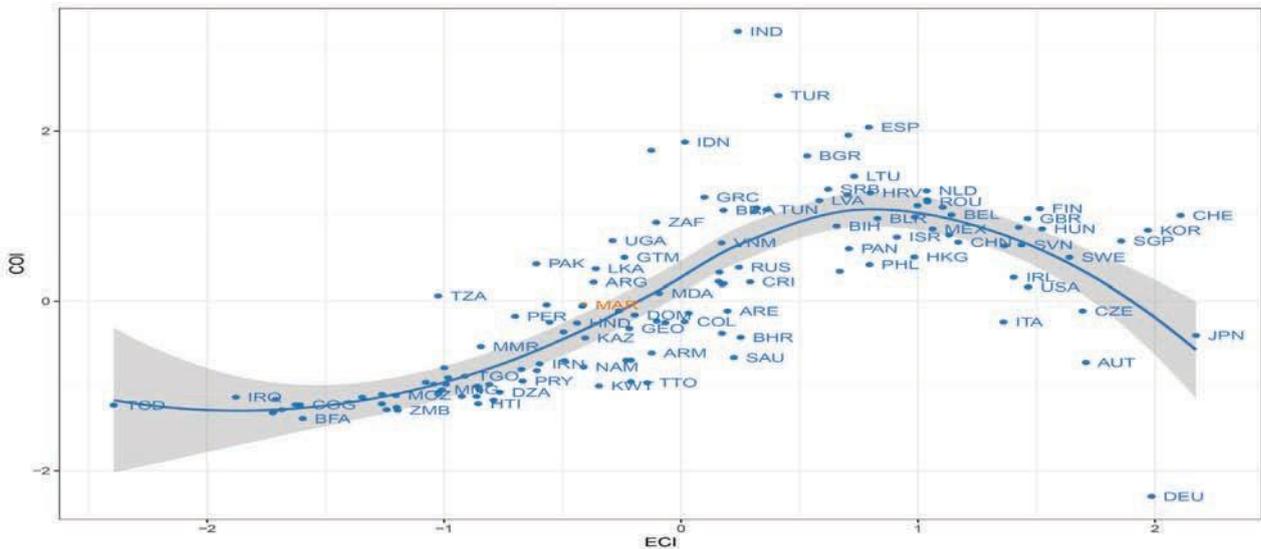
$$COI = \sum_{p'} (1 - d_{c,p}) (1 - M_{cp'}) PCI_{p'}$$

A consequence of the previous observation is the existence of a difference in quality between the configurations of the product space of each country. On the one hand, some countries export products that are close to other more complex products, which could allow them to position themselves more easily since they do not require the acquisition of a significant amount of non-existent productive capacities. On the other hand, a country which exports only isolated products will find it more difficult to diversify since this reveals the absence of several productive capacities. In this sense, the complexity outlook index provides a holistic measure of the quality of positioning in the product space.

Thus, the countries with the lowest levels of economic complexity often export poorly connected products and have equally low prospects for complexity. On the other hand, by exporting more complex products, the index of economic complexity tends to increase and that of the complexity outlook tends to decrease. In the extreme, however, a country that already exports all of the more complex products can no longer export additional products without being less complex. The relationship between the economic complexity index and that of the economic complexity outlook (Graph 7) therefore shows an inverted U curve.

This allows us to observe, graphically, the countries that are likely to be on the path of economic convergence. In 2016, India had the highest complexity outlook index. As a result, it is in a good position to acquire new productive capacities, increase its economic complexity and, thus, accelerate its economic convergence. In 2016, India was in the position that China occupied in 2000. The development of the latter continued and its complexity outlook index decreased as its economic complexity index increased.

Graph 7: Relationship between ECI and COI



Source: DEPF calculations

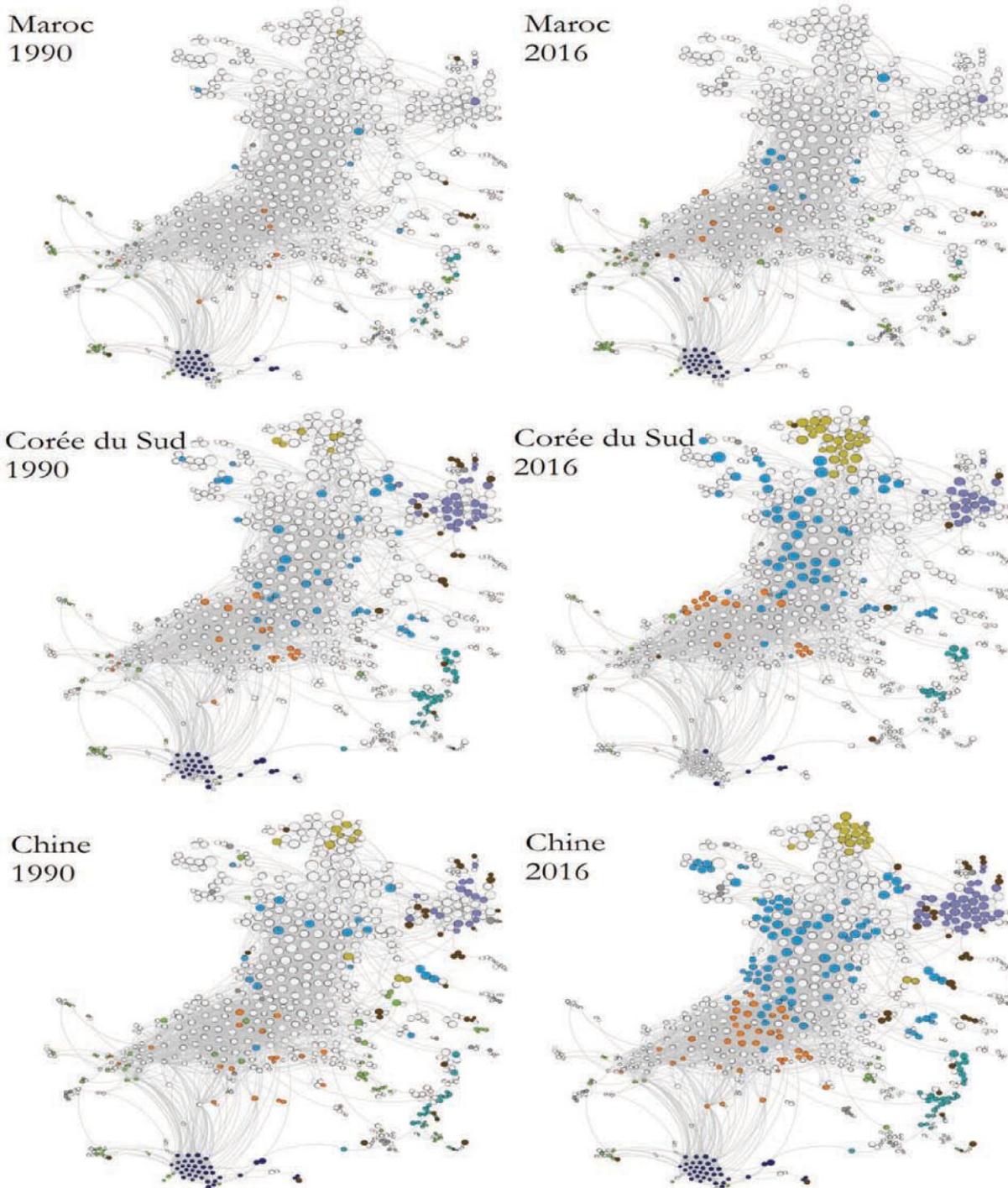
3.3. EVOLUTION OF MOROCCO'S PRODUCT SPACE

As previously mentioned, a comparative examination of the historical evolution of Morocco's economic complexity; shows that Morocco displays a gradual improvement in its productive capacities. However, the rate of acquisition of these capacities is still insufficient to put it on an accelerated path of economic convergence. This is seen in the evolution of Morocco's positioning in the product space (Graph 8), especially compared to countries that are on the path of economic convergence. The differences in evolution observed are both qualitative and quantitative.

For instance, South Korea succeeded, over the period 1990-2016, in exporting new products from the industrial, manufacturing and chemicals and health sectors. It maintained its positions in electronics, but almost completely abandoned the majority of the textile-clothing sector. As for China, which is still present in the clothing and textile-spinning industries, it was able to export, over the same period, almost all electronic products and is increasingly positioning itself with the most complex industrial and manufacturing products.

Morocco, while maintaining its traditional export positions as observed in 1990, was able to diversify its exportable offer to integrate new industrial and manufacturing products, mainly those within the framework of World Professions of Morocco. However, this diversification took place at a relatively slow pace. As proof, a significant part of the product space remains untapped so far.

Graph 8: Evolution of the product space of different countries



Source: DEPF calculations

Morocco – South Korea - China

At this point, it should be noted that the product space is not an alternative description of the export basket. The fact that a country manages to export a given product with a comparative advantage reveals that it has the productive capacities necessary to produce it efficiently, whatever its capacities may be. Similarly, a country that maintains its positioning with low complexity products leads us to believe that it faces challenges in terms of the acquisition of its productive capacities.

The distance between two products in the product space measures the similarity of their underlying productive capacities and therefore the difficulty of acquiring a positioning on a product from another. This suggests that each configuration of the product space offers different possibilities for diversification. Morocco, having acquired new positions thanks to its global businesses, sees its diversification possibilities multiply. The next section identifies its possibilities and offers recommendations to facilitate the process of acquiring new productive capacities.

4. MOROCCO'S DIVERSIFICATION STRATEGY

4.1. METHOD OF IDENTIFYING DIVERSIFICATION POTENTIAL

In addition to the notions of product complexity and distance between a country's export basket and products, a third criterion has been introduced to be able to identify the products that open up the most possibilities for new positioning. This is the "complexity outlook gain" which allows a breakdown of the complexity outlook index by product. The latter identifies the products that open up the most possibilities for new positioning. The complexity outlook gain is obtained by using the following formula:

$$COG_{c,p} = (1 - d_{c,p})(1 - M_{cp})PCI_p$$

In other words, the products in which Morocco should diversify, by acquiring the related productive capacities, must meet the following three criteria:

1. **Complex:** The complexity of the product is greater than the average complexity of the products currently exported.
2. **Achievable:** The distance between the current basket and the new product is less than the median distance.
3. **Promising:** The complexity outlook gain is greater than 0. The product must be well connected, thus allowing new possibilities for diversification.

The three criteria make it possible to identify the most relevant products for a diversification strategy, however, in order to avoid a difficult simultaneous pursuit of all positioning; we rank the products by giving more importance to one criterion over the rest. To do this, two approaches¹⁰ can be adopted for exploring the product space:

- **Parsimonious transformation:** Proximity is more important than the other two criteria. The highest ranked products present the best complexities and complexity outlook gains for relatively short distances. These products are ranked according to the parsimonious transformation index:

$$ITP = 0.2 \cdot PCI + 0.2 \cdot COG + 0.6 \cdot (1 - \text{Distance})$$

- **Strategic options:** Complexity and complexity outlook gain are more important than proximity. The highest ranked products, according to this criterion, are more distant and their capacities are therefore more difficult to acquire, but they are, on the other hand, more complex and better connected. Strategic options can be ranked by the Strategic Options Index (IPS):

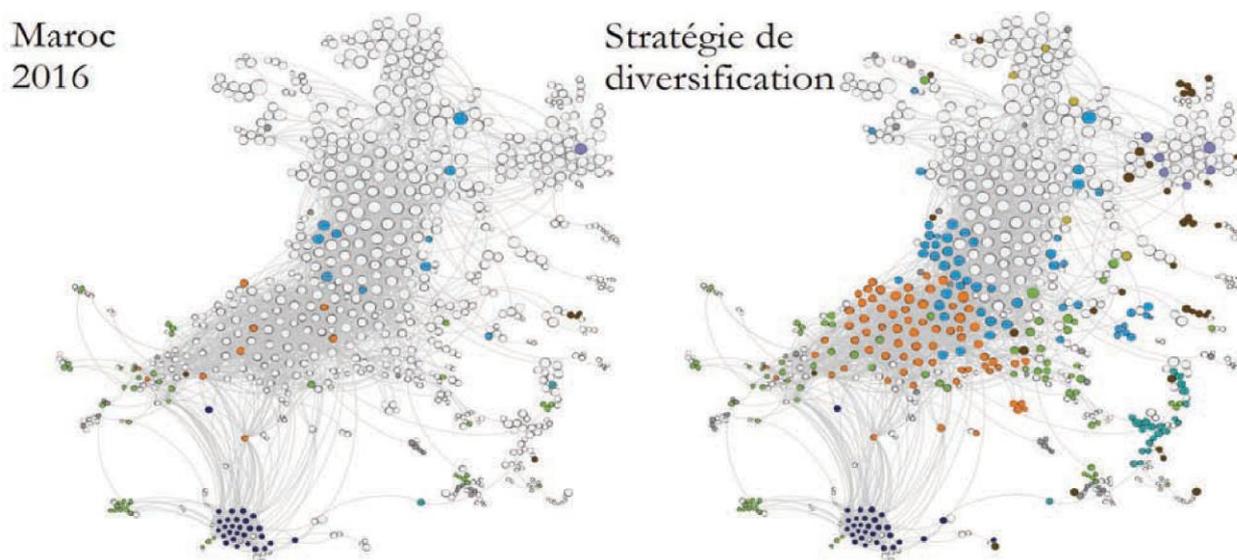
$$IPS = 0.4 \cdot PCI + 0.4 \cdot COG + 0.2 \cdot (1 - \text{Distance})$$

¹⁰ Hausmann, Cunningham, and al. (2014).

4.2. PATHS FOR THE DIVERSIFICATION OF MOROCCO'S ECONOMY

Exploring the product space using these criteria has identified 209 products¹¹ of which Morocco could acquire the productive capacities in order to accelerate its development process. Most of these products are in manufacturing, textile and the least complex part of the industry (Graph 9). At this stage, a more detailed product ranking makes it possible to identify more precisely the products whose acquisition will allow Morocco to develop its economic complexity.

Graph 9: Product Space: Diversification Strategy



Source: TRADEMAP

Therefore, by adopting the same previous criteria and using the 2016 trade data according to the 2002 version of the harmonized system with 6 digits, the procedure made it possible to identify 1,370 products (out of 4,575 products) on which Morocco would benefit from positioning itself.

The two indices allowed the ranking of the 1,370 products according to two diversification approaches. Table 3 shows the first 20 products that are related, but relatively less complex. As for Table 4, it presents the first 20 products which are more complex, better connected, but less related. Therefore, the products identified are not all feasible, some may depend on natural resources not available in Morocco, and others may not have trade opportunities with Morocco's trading partners...

¹¹ Out of 769 products.

Table 3: The first 20 products of parsimonious transformation

HS Code	Product	ITP	IPS	PCI	GPC	Distance	RCA
761010	Aluminium Doors, windows, frames and thresholds	1,71	0,10	0,04	0,02	0,80	0,10
760429	Bars, rods and other profiles, aluminium alloyed	1,67	0,53	0,28	0,09	0,81	0,06
340220	Washing and cleaning preparations, retail	1,46	-0,04	-0,08	0,03	0,81	0,07
441510	Wooden cases, boxes, crates, drums and containers	1,44	0,04	-0,02	0,04	0,81	0,09
730630	Pipes etc nes, iron/steel welded nes, diameter <406.4m	1,42	-0,18	-0,13	0,01	0,80	0,04
940560	Illuminated signs, illuminated nameplates etc	1,41	0,23	0,14	0,06	0,81	0,14
190540	Rusks, toasted bread and similar toasted products	1,40	-0,50	-0,49	0,00	0,80	0,00
481960	Office box files, letter trays etc., of paper	1,39	-0,01	-0,13	0,06	0,81	0,12
210500	Ice cream and other edible ice	1,37	-0,16	-0,20	0,03	0,81	0,01
190590	Communion wafers, rice paper, bakers' wares nes	1,34	-0,28	-0,34	0,03	0,81	0,11
730890	Structures and parts of structures, iron or steel, ne	1,34	0,39	0,26	0,09	0,82	0,15
721690	Angles/shapes/sections, iron or non-alloy steel, nes	1,34	-0,20	-0,12	0,01	0,81	0,03
690590	Ceramic construction items, chimney pots and cowls	1,30	-0,26	-0,35	0,05	0,81	0,26
730900	Reservoirs/tanks/vats/etc, iron/steel capacity >300l	1,30	-0,04	-0,05	0,04	0,81	0,19
850710	Lead-acid electric accumulators (vehicle)	1,29	-0,30	-0,28	0,02	0,81	0,36
721440	Bar/rod, iron or non-alloy steel, hot formed <0.25%C, nes	1,29	-0,25	-0,14	0,00	0,81	0,25
730840	Props etc for scaffold, shuttering, pits, iron/steel	1,25	0,14	0,13	0,05	0,82	0,36
630292	Toilet or kitchen linen, of flax	1,22	-0,29	-0,24	0,02	0,81	0,00
300410	Penicillin's and streptomycin's, derivs, in dosage	1,18	0,01	0,07	0,04	0,82	0,21
940600	Prefabricated buildings	1,17	-0,17	0,02	0,00	0,81	0,27

Source:DEPF
calculations

Table 4: The top 20 products of the strategic options

HS Code	Product	ITP	IPS	PCI	GPC	Distance	RCA
741521	Copper washers, including spring washers	0,32	2,02	1,16	0,43	0,88	0,01
392113	Sheet etc., cellular of polyurethane	0,48	1,99	1,09	0,42	0,87	0,01
400930	Rubber tube, pipe, hose textile-reinforced no fitting	0,26	1,90	1,07	0,42	0,88	0,01
392630	Plastic fittings for furniture, coachwork, etc.	0,28	1,86	1,02	0,42	0,87	0,56
870839	Brake system parts except linings for motor vehicles	0,30	1,86	1,02	0,42	0,87	0,28
840690	Parts of steam and vapor turbines	0,22	1,84	1,02	0,42	0,88	0,05
850151	AC motors, multi-phase, of an output < 750 Watts	0,23	1,83	1,06	0,40	0,88	0,01
840410	Auxiliary plant for steam/vapour generating boilers	0,19	1,80	1,10	0,39	0,88	0,01
732219	Radiators and parts thereof, iron or steel except cas	0,46	1,78	1,09	0,36	0,87	0,00
851290	Parts of cycle & vehicle light, signal, etc equipment	0,48	1,77	0,98	0,38	0,87	0,49

846291	Hydraulic presses for working metal	0,19	1,71	1,12	0,36	0,88	0,01
846231	Num controlled shearing (non-punching) machine tools	0,28	1,69	0,99	0,38	0,87	0,00
843131	Parts of lifts, skip hoist or escalators	0,21	1,67	0,97	0,38	0,87	0,00
851680	Electric heating resistors	0,77	1,64	1,03	0,31	0,86	0,01
842131	Intake air filters for internal combustion engines	0,33	1,62	1,05	0,34	0,87	0,34
840310	Central heating boilers nes	0,14	1,62	1,04	0,36	0,87	0,00
830160	Lock parts, etc, of base metal,	0,69	1,60	0,80	0,36	0,86	0,37
840999	Parts for diesel and semi-diesel engines	0,64	1,56	0,93	0,32	0,86	0,60
381600	Refractory cements, mortars, concretes except graphite	0,33	1,54	1,01	0,33	0,87	0,03
851690	Parts of electro-thermic apparatus, domestic, etc	0,87	1,53	0,91	0,30	0,85	0,01

Source: DEPF calculations

This approach, which consists of exploring the products that should support the production diversification strategy, helps to shed light on the strategic choices to be made. It restricts these choices by eliminating the search for positioning that does not allow for the acquisition of new productive capacities and those whose production involves the acquisition of many missing productive capacities, which could prove costly and ultimately lead to the failure of the diversification strategy adopted.

The share of products identified in Moroccan exports is 3.8%, while representing 27.3% of world trade in 2016. The diversification margin therefore turns out to be substantial and relates, for the most part, to moderately complex manufacturing and industrial products (Table 5).

Table 5: Products classified by section of the harmonized system

HS Section	Descriptions	Identified	Lines	RCA
16	Machines and devices, electrical equipment and parts thereof, sound recording or reproducing devices, devices for recording or reproducing images and sound in television, and parts and accessories thereof	230	723	32
15	Common metals and products thereof	207	519	22
11	Textiles and textile products	181	734	217
6	Products of the chemical or allied industries	144	674	32
10	Pulp of wood or other fibrous cellulosic material, paper or cardboard to be recycled (waste and scrap); paper and its applications	68	130	8
7	Plastics and articles thereof; rubber and rubber products	66	187	9
13	Articles of stone, plaster, cement, asbestos, mica or similar materials, ceramic products; glass and glassware	62	129	11
20	Miscellaneous goods and products	60	116	3
1	Live animals and products of animal origin	58	190	38
4	Food industry products; beverages, spirits and vinegar, tobacco and manufactured tobacco substitutes	54	174	26

18	Optical, photographic, cinematographic, measuring, checking, or precision instruments and appliances; medical and surgical instruments and apparatus; watches; musical instruments ; parts and accessories of these instruments or apparatus,	43	204	4
2	Vegetable products	42	238	55
17	Transportation equipment	36	127	13
5	Mineral products	36	138	26
9	Wood, charcoal and wooden articles; cork and articles of cork; works of plaiting or basketwork	27	69	7
8	Skins, leathers, furskins and articles thereof; harness or saddlery; travel goods, handbags and similar containers; casings	15	53	11
19	Weapons, ammunition and their parts and accessories	12	16	0
14	Natural or cultured pearls, precious or semi-precious stones, precious metals, precious metal plates or doubles and articles thereof, costume jewelry; currencies	10	50	2
12	Shoes, headgear, umbrellas, parasols, walking sticks, whips, whips and their parts; prepared feathers and articles made of feathers; artificial flowers; hair articles	9	47	15
3	Animal or vegetable fats and oils; products of their dissociation; processed food fats; animal or vegetable waxes	7	49	9
21	Works of art, collectibles or antiques	1	7	0

Source: DEPF calculations

4.3. RECOMMENDATIONS FOR FACILITATING THE DIVERSIFICATION PROCESS

The developments listed above show the efforts made by Morocco for the structural transformation of its economy and the sophistication of its production system. These efforts, as promising as they may be, do not seem to have led, thus far, to a substantial increase in the pace of economic growth in general and that of GDP per capita in particular.

This situation is the result of the current level of economic complexity in Morocco, which does not offer significant margins for widening the spectrum of national wealth creation and its development on a self-sustaining basis.

Thus, any positive change in this situation would inevitably involve the further development of the economic complexity of the country and consequently, the acceleration of the pace of convergence as is the case for many developed and emerging countries.

Such an ambition requires strong and sustained action on the part of the public authorities in terms of loosening the structural constraints that strain the country's growth potential, and prevents it from fully capitalizing on the opportunities offered to it by the density of the reforms undertaken and the promising momentum of the integration of its production system into regional and global value chains.

Based on the results of the diagnosis listed in the previous sections and drawing on lessons learned from the experience of certain successful countries, some suggestions have been made in regard to boosting the economic complexity of Morocco and leverage the acceleration of the country's growth and development process. These suggestions, while not claiming to be exhaustive, comprise three interdependent components.

⇒ Mobilize in the short term the opportunities offered in several sectors of the national economy

Aside from optimizing public programs and public sector strategies at work, the mobilization of new sources of growth that the Moroccan economy harbors, would open up new prospects in terms of widening the spectrum of national wealth and creating sustainable and high-quality jobs.

In the agricultural industry, a few sectors, including the food sector, could constitute an important growth driver and a key factor in improving the living conditions of rural populations. A better upstream-downstream integration of the agri-food sector and its competitive modernization would boost export performance of this sector and hence its contribution to national added value.

In the secondary sector, the competitive redevelopment of the Moroccan industry, particularly in terms of Morocco's global trades, would make it possible to widen the production frontier to enhance both the capacity of this sector to satisfy the domestic market and to further develop its export offer.

As for the service sector, additional momentum would be necessary to consolidate the developments observed in recent years by fully mobilizing the potential of certain flagship activities, such as tourism and the financial sector, and by intensively promoting activities of a structuring nature, such as logistics and activities within the framework of the new economy, for the purpose of supporting promising sectors in the national economy.

⇒ Promote the transition to a new level of industrialization in the country

In the relentless quest to promote Morocco's full entry into the circle of emerging countries, particular attention should be paid to the successful implementation of the industrialization strategy. This strategy would benefit from being more focused on the effective development of trade policy and the policy relating to the attractiveness of foreign investments, while creating favorable conditions for the internationalization of Moroccan SMEs, especially in sub-Saharan Africa and in certain markets around the Mediterranean.

In addition to the specializations adopted within the framework of Morocco's global professions, particular attention should be paid to the green economy sectors (solar, wind, smart grids, etc.), in order to mobilize the potential of these promising niches, identify the industrialization options of our country that are in perfect coherence with the requirements of environmental sustainability and adapt already to the imperatives of the new competitive order that is emerging.

It is also important to promote a new generation of Morocco's global professions, focused on attributes of intangible competitiveness, to base the country's industrialization on solid and lasting foundations; these are the cultural and artistic industry as well as the sectors rich in traditional know-how, which has been accumulated by Morocco over generations.

Moreover, the successful integration of Morocco into global value chains requires substantial efforts to overcome the obstacles encountered so far. In addition to upgrading the structure of the industry and the emergence of local value chains, by way of existing ecosystems or those to be created, the steps required of foreign investors, in terms of minimum local content, should be generalized to all industrial sectors, to promote the transfer of knowledge and technology and allow the emergence, as part of a joint venture, of an efficient economic fabric of local industrial companies.

While facing its ambitions for successful African integration, participation in the development of a regional production network would allow Morocco to act as a catalyst for industrial FDI in other African countries, with the potential of strengthening positioning of the region in global value chains. The PSA plant based in Kenitra is a good example since this plant will constitute an important industrial base which will supply assembly units to other African countries.

⇒ **Continuously relay the action of the public authorities through cross-cutting support measures**

In addition to the aforementioned levers, particular attention should be given to certain structuring factors to facilitate the structural transformation of the national economy, and to provide solid and lasting foundations. Among the measures recommended in this regard, it is particularly worth mentioning:

- The constant boost of the general investment climate, by overcoming certain obstacles relating in particular to the dematerialization of procedures, the vigorous fight against corruption and access to land. This also presents a challenge to the optimized functioning of economic regulation bodies to guarantee the conditions for healthy and fair competition and restore the trust of economic players.
- The promotion of both initial and continuing training in technical fields, support for research and innovation, in particular through incentives for filing patents and for research and development and partnerships between the private sector and the academic world (universities, engineering schools, etc.) are all structuring projects likely to promote the structural transformation of the Moroccan economy.
- The use of greater territorial coverage of public policies to make it a lever of structural convergence, which would allow the mobilization of the great potential available to the regions of the Kingdom on a large scale, and make it a sustainable source of the competitiveness and attractiveness of the Moroccan economy.

Bibliographic references

1. Andrews, M., Pritchett, L., & Woolcock, M. (2013). Escaping capability traps through problem driven iterative adaptation (PDIA). *World Development*, 51, 234-244.
2. Andrews, M., Pritchett, L., & Woolcock, M. (2017). *Building state capability: Evidence, analysis, action*. Oxford University Press.
3. Andrews, M., Pritchett, L., Samji, S., & Woolcock, M. (2015). Building capability by delivering results: Putting Problem-Driven Iterative Adaptation (PDIA) principles into practice. *A Governance Practitioner's Notebook*, 123.
4. Balassa, B. (1965). Trade liberalization and "revealed" comparative advantage 1. *The Manchester School*, 33, 99-123.
5. Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: an open source software for exploring and manipulating networks. *Third international AAAI conference on weblogs and social media*.
6. Caria, S., Troyano, M. C., & Martiñón, R. D. (2017). Can the Monkeys Leave the Export Processing Zones? Exploring the Maquiladora Bias in the Economic Complexity Index in Latin America. *Journal of Economics*, 5, 20-28.
7. Hausmann, R., & Chauvin, J. (2015). Moving to the adjacent possible: Discovering paths for export diversification in Rwanda. *Tech. rep.*, Center for International Development, Harvard University.
8. Hausmann, R., & Klinger, B. (2007). The structure of the product space and the evolution of comparative advantage. *Tech. rep.*, Center for International Development, Harvard University.
9. Hausmann, R., & Rodrik, D. (2006). The Binding Constraints to Growth in Morocco. In *Fostering High Growth and Employment in the Kingdom of Morocco* (pp. 15-49). Washington, DC: The World Bank.
10. Hausmann, R., Cunningham, B., Matovu, J. M., Osire, R., & Wyett, K. (2014). How should Uganda grow? *Tech. rep.*, Center for International Development, Harvard University.
11. Hausmann, R., Hidalgo, C. A., Bustos, S., Coscia, M., Simoes, A., & Yildirim, M. A. (2014). *The atlas of economic complexity: Mapping paths to prosperity*. Mit Press.
12. Hidalgo, C. A., & Hausmann, R. (2009). The building blocks of economic complexity. *Proceedings of the national academy of sciences*, 106, 10570-10575.
13. Hidalgo, C. A., Klinger, B., Barabási, A.-L., & Hausmann, R. (2007). The product space conditions the development of nations. *Science*, 317, 482-487.
14. Lall, S. (2000). The Technological structure and performance of developing country manufactured exports, 1985-98. *Oxford development studies*, 28, 337-369.
15. Rosvall, M., & Bergstrom, C. T. (2008). Maps of random walks on complex networks reveal community structure. *Proceedings of the National Academy of Sciences*, 105, 1118-1123.
16. Tacchella, A., Cristelli, M., Caldarelli, G., Gabrielli, A., & Pietronero, L. (2012). A new metrics for countries' fitness and products' complexity. *Scientific reports*, 2, 723.



CONTACT

Address

DEPF
Boulevard Mohamed V.
Quartier Administratif,
Rabat-Chellah Maroc

Phone

(+212) 5 37.67.74.15/16

Online

Email : depf@depf.finances.gov.ma
Website: depf.finances.gov.ma
