# A theory of capabilities for productive transformation: Learning to catch up

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## 4.1 Introduction

Patterns and processes of productive transformation have varied greatly across countries. Some countries have shown high performance, sustaining rapid growth over long periods. These high-performing countries have managed to achieve a pattern of growth and structural transformation that has led to fast and sustained technological change and productivity growth, the generation of more and better jobs, more sophisticated occupational structures, and employment patterns that result in rising incomes and in poverty reduction. In short, they achieved high-performing catching-up growth and economic development. Others have gone through a more fitful and uneven transformation process with growth spurts followed by slowdowns. Yet others have failed to trigger much in the way of transformation, continuing to rely heavily on traditional activities in the rural economy and informal activities in the urban economy.

This differentiated performance among countries and regions in their patterns and processes of catching up raises significant policy issues and challenges. One of them is the role of capabilities in productive transformation. Economists take different perspectives on how capabilities enable and shape productive transformation. One strand of the literature, the structural change perspective, argues that capabilities determine the products and technologies that firms and economies can easily develop (Hausmann et al., 2011; Richardson, 1972). A second strand, the process perspective, discusses capabilities as the determinant of the behaviour of firms and economies and their competences to perform such tasks as coordinating, investing, innovating, identifying and solving problems, and learning

(Chang, 2010; Dosi, Winter and Nelson, 2000; Lall, 1992 and 2000; Nelson, 2008; Nelson and Winter, 1982; Sutton, 2012; Teece, Pisano and Shuen, 1997). Thus, these two separate strands of the literature discuss capabilities as the determinants of two dimensions of productive transformation: the *patterns* as well as the *process* of structural transformation. Development economics, however, so far has failed to integrate these two perspectives into a growth and productive transformation model.[1]

Mainstream growth models have largely neglected capabilities. These models view economic development as a process of production factor and technology accumulation, assuming a mechanistic relationship between investment in productive capacities and growth, with market forces driving the accumulation and growth process. Robert Lucas (1988) summarizes this perspective in his article "On the mechanics of economic development". He distinguishes three accumulation models: "[A] model emphasizing physical capital accumulation and technological change, a model emphasizing human capital accumulation through schooling, and a model emphasizing specialized human capital accumulation through learning-by-doing. Two decades after Lucas published his article, the Commission on Growth and Development (2008, p. 37) concluded that economists still lack a good understanding of the link between technology, human capital, education and training on the one hand, and economic growth on the other one, that therefore "[researchers] may have the wrong model of growth" and that, due to country-specific capabilities, there is no "one size fits all" set of rules to guide policy-makers seeking to promote growth.

This chapter shifts focus from the *mechanics* to the *dynamics* of economic development by elaborating an analytical framework to better understand the process of catching up and the forces driving its dynamics. The framework introduces capabilities as a key determinant of catching up and economic development.

To date, however, despite the centrality of capabilities in the literature on productive transformation, the concept has remained a black box. Dosi, Winter and Nelson (2000, p. 1) note that "[t]he term 'capabilities' floats like an iceberg in a foggy Arctic sea, one iceberg among many, not easily recognized as different from several icebergs nearby". This chapter therefore develops a theory of capabilities to explain how capabilities shape the dynamics of catching up, where the different types of capabilities reside, how they are created and transformed, and the role of policies in promoting and shaping them.

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[1] It is important to distinguish this "productionist" view of capabilities from the "humanistic" view developed by Amartya Sen (Chang, 2010). Sen developed a concept of human capabilities to provide a new measure for development. In contrast, the "productionist" view explains how collective capabilities at the level of firms and economies shape structural and technological change in the economy.

The theory consists of three components. First, a concept of catching up is elaborated which defines the phenomenon as a process of productive transformation reflected in diversification into new products and higher value added activities as well as in technological upgrading, the creation of more productive and better jobs and employment patterns that result in rising wages and poverty reduction. The catching-up concept views productive capabilities and productive capacities as two fundamentally different but interrelated concepts, integrates the structural change and process dimension of productive transformation discussed by distinct economic traditions, and elaborates the channels through which capabilities shape both dimensions of productive transformation and thereby determine growth.

With this in mind, the chapter develops a knowledge-based concept of capabilities, the second component of the theory of capabilities for productive transformation. The concept argues that the capabilities to drive and govern productive change are embodied in various collective, shared or aggregate forms of knowledge at the levels of enterprises, the labour force, economies and societies. Hence, while productive capacities reside in the "material" sphere of the economy (in tangible production factors and infrastructure), productive capabilities exist in the "non-material" or in the intangible sphere of knowledge.[2] Figure 4.2 depicts the knowledge-based capability concept linked to the catching-up framework.

The development of capabilities is therefore essentially a process of learning. Hence, there is a need to elaborate a concept of learning which explains how capabilities are generated. Economists, however, have only a limited understanding of the nature of the learning processes that lead to expanding capabilities for high-performing catch-up growth and economic development.[3] This chapter therefore elaborates a concept of learning which draws on explicit theories of knowledge and learning developed in different disciplines such as philosophy, cognitive science and sociology (e.g. Bandura, 1986; Boyd and Richerson, 1985; Polanyi, 1958), and applies them to the economic context.

This interdisciplinary approach shows that learning to catch up is a complex and costly process, involving the accumulation of different forms of knowledge,

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[2] This distinction between the material and the knowledge sphere in explaining economic development goes back to List (1909 [1841]), and was highlighted more recently by the "new" economic historians such as McCloskey, Goldstone and Mokyr (see Nübler, forthcoming).

[3] Economic growth and trade theories use concepts such as "learning-by-doing" or "knowledge spillovers". The learning process, however, is not explicitly modelled, but is assumed to occur as the result or "by-product" of production (Arrow, 1962), trade (Young, 1991) and investment in R&D (Cohen and Levinthal, 1989). Human capital theory assumes that learning by individuals takes place as a result of investment in education and training. Stiglitz (1999) discusses knowledge as a public good and public policy implications for the provision, use, transfer and dissemination of such goods.

characterized by distinct properties and acquired through fundamentally different learning processes – an observation that highlights the relevance of learning not only in schools but also in the production system and in social, cultural and organizational networks. Moreover, the concept demonstrates the relevance of learning not only at the level of individuals, but also at the collective level of social groups – in enterprises, organizations, the economy and society as a whole. In addition, learning itself represents a capability. Learning to learn is therefore a central feature of high-performing learning systems in a dynamic economic context. This concept of collective learning is the third component of the theory of capabilities for productive transformation.

The theory of capabilities contributes to a better understanding of the link between education, training and technological learning on the one hand and economic growth on the other hand. This link was identified as a knowledge gap by the Commission on Growth and Development (2008). The knowledge-based concept of capabilities linked to productive transformation shows that transformation of capabilities through individual and collective learning drives the dynamics of catching up by enhancing the range of options for diversification and the collective competences necessary to generate rapid and sustained processes of productive transformation.

The framework defines a wide scope for industrial policies as they are challenged with promoting the co-evolution of the two interrelated processes of building capabilities for productive transformation in a learning process, and accumulating productive capacities through investment in production factors, in existing as well as new and advanced industries. This chapter is focusing on policies to promote the evolution of capabilities in the knowledge sphere. The framework offers recommendations for an integrated learning strategy that creates capabilities for high-performing patterns and processes of productive transformation. Such a learning strategy embraces education, training, technology, R&D, trade and investment policies, promoting learning in all sectors, at all levels and in multiple locations, as well as fostering institutions to trigger, accelerate and sustain these learning processes. The learning strategy forms an essential part of an industrial and economic development agenda.

This chapter is structured as follows: Section 4.2 sets out a concept of catching up that focuses on the dynamics of economic transformation and introduces capabilities as a main driver of catching-up dynamics. Section 4.3 presents a knowledge-based concept of capabilities, explaining where capabilities reside (collective memories), and Section 4.4 explains how capabilities are generated (collective learning). Section 4.5 outlines a learning strategy for creating a high-performing process of capability development. Section 4.6 draws conclusions.

## 4.2 A dynamic concept of catching up

This section develops a concept of catching up by drawing on different traditions in development economics, ranging from the German historical school to institutional, evolutionary and structural economics. It recognizes the wide potential of developing countries to catch up in the light of their imitating or borrowing existing products and technologies from around the world, but also explains the limits developing countries face in exploiting these potentials.

### *4.2.1 Two dimensions of catching up*

The concept maintains that the dynamics of catching up are determined by the structural change and process dimensions of productive transformation. The structural change dimension relates to the patterns of change in the economic structure (diversification, product differentiation and technological upgrading) while the process dimension relates to the pace and sustainability of this change. Performance in catching up is measured in terms of both patterns and processes of productive transformation.

#### Patterns of productive transformation – What you produce matters

The pattern of change in the economic structure is important as it determines the extent to which countries can achieve their development goals. Indeed, "... not all goods are alike in terms of their consequences for economic performance" (Hausmann et al., 2007, p. 1). Some patterns of structural and technological change and specialization in certain goods contribute more than others to improvements in productivity, income and wages, the generation of more productive and higher quality jobs, and opportunities for learning in the production process.

Empirical evidence shows that high productivity growth rates were achieved in countries that were able to shift production from traditional to modern activities, in particular to tradable and industrial products, and to develop relatively complex export goods (Hausmann, Hwang and Rodrik, 2007; Rodrik, 2009). Manufacturing has been identified as a "leading sector" in the process of productive transformation due to its economies of scale, strong backward and forward linkages, and widespread opportunities for technological progress and knowledge spillover. Furthermore, manufacturing generates a substantial

number of productive jobs, through direct effects as well as through indirect effects created by linkages to other sectors and income-induced effects.[4]

Ocampo, Rada and Taylor (2009) identify manufacturing as the sector with the highest potential for productivity and employment growth in low-income countries, although technological upgrading and diversification within agriculture are also important to support productive transformation. In contrast, in higher-income countries with rapid long-term growth, manufacturing has served as an engine for productivity growth, but not for job creation; here, net growth in jobs has come from the service sector. Roncolato and Kucera (2013) discuss the potential role of advanced services as a "leading sector" in economic development, highlighting competing perspectives among economists and arguing that the service sector can be a lagging complement to manufacturing, a leading complement to manufacturing or a substitute for manufacturing.

An emerging literature is analysing the impact of technological change on the properties of tasks and jobs and thereby on the quality of employment. Jobs and tasks are allotted to categories such as routine, non-routine, analytical, interactive, manual, cognitive, skilled or unskilled (Autor, Levy and Murnane, 2003; Balconi, Pozzali and Viale, 2007; Chandler, 1977). Since technologies and production processes used in different economic sectors differ in important economic properties such as fragmentability, factor intensity, modularization, automation of tasks, and knowledge base, they are associated with different job profiles. Consequently, the nature of technological change promoted in a catching-up strategy has important implications for the quality of jobs and the occupational structure of the economy (Nübler, forthcoming).[5]

Countries also need to strike a good balance in achieving multiple development objectives, taking account of potential synergies and trade-offs. Rapid technological deepening and the labour-saving nature of technological change drive productivity growth, but also destroy jobs. The challenge facing developing countries is therefore to diversify into a broad range of new economic activities (and promote domestic and foreign demand) in order to generate new jobs to achieve positive net employment effects. Comparative analysis of productive transformation processes in the Republic of Korea and Costa Rica during the 1960s and 1970s demonstrates that the Republic of Korea achieved significant higher growth rates in productivity and employment by simultaneously promoting industrial widening and technological deepening, while in Costa Rica,

[4] See Lavopa and Szirmai (2012) for a review of the literature.

[5] See, for example, Lall (2000); Pavitt (1984); Perez (1983); Nelson and Winter (1982).

industrial widening moved more slowly than technological deepening (Nübler, forthcoming).

These empirical findings suggest that countries' performance in terms of patterns of structural and technological change need to be assessed in the light of their development objectives and the aspirations of their societies. There is no "one-size-fits-all" pattern of high-performing productive transformation.

## Processes of productive transformation – Pace and sustainability

In addition to high-performing patterns, countries need to develop a high-performing process of productive transformation. This is important in light of high unemployment rates, fast-growing numbers of young people entering the labour market and persistent poverty in many developing countries. High-performing processes are expressed in fast expansion of productive capacities and rapid productive transformation, absorbing technology and diversifying into a wide scope of different products and industries. Reinert (2009) finds that countries achieving a rapid pace of catching up jumped into leading technological paradigms which created "productivity explosions" through increasing returns, fast learning, synergies, innovation and rapid diversification.

High performance of processes is also measured in terms of sustainability. Countries can move from low to middle and then to advanced income levels only if they can sustain high growth rates in income per capita for a significant period of time. The recent debate on the "middle-income trap" suggests that moving from the middle to the advanced income level seems to be a challenge for many middle-income countries. Growth rates tend to decline as they approach the upper middle-income thresholds, and, thus, these countries risk falling into the middle-income trap.[6] While a growing body of studies explores empirically trends and factors that are related to declining growth dynamics in middle-income countries, development economics does not provide models or frameworks to explain the middle-income trap.

To summarize: the two dimensions of productive transformation and catching up are complementary, and therefore need to evolve together. Successful catching up requires high performance in both the structural change and the process dimensions of catching up.

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[6] See, for example, Agénor and Canuto (2012); Eichengreen, Park and Shin (2011); Foxley and Sossdorf (2011); Jankowska, Nagengast and Perea (2012).

### 4.2.2 Productive capacities and productive capabilities

The concept of catching up elaborated in this chapter defines catching up as a dynamic process of productive transformation. This concept distinguishes between the "catching-up potential" and the "feasible" or "realistic" space for catching up. The gap between a country's portfolio of mastered techniques, activities and products and those available at the global level defines its "catching-up potential". In figure 4.1 the global product and technology space (GPTS) describes the technologies and products that exist in the world, while the productive capacities space describes a country's existing portfolio of technologies and products it masters at a particular point of time. Hence, a country's catching-up potential is benchmarked against the GPTS. Productive capacities are determined by the production factors accumulated in the country.

Gerschenkron (1962) views the gap between the GPTS and a country's productive capacities as the "benefits of backwardness", as it provides the potential for developing countries to develop rapidly by borrowing technologies from the rest of the world and imitating products already produced in more advanced countries. The challenge facing developing countries is to catch up within the GPTS, to imitate a wide range of different products, to expand the scope of their own economic activities and technologies within the GPTS, to navigate rapidly through this space and to sustain this process.

This concept of catching up argues that each country or society has developed a specific set of capabilities that determines its feasible scope for expanding productive capacities and catching up within the GPTS. They determine a country's realistic direction of change and the nature of the diversification, product differentiation and technological upgrading that a country can achieve. The feasible

Figure 4.1 A concept of catching up