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# Global value chains, skills and innovation activities in firms: conceptual issues

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## Pijus Krūminas

Visionary Analytics  
M.Valančiaus 1A, 03155 Vilnius, Lithuania  
[pijus@visionary.lt](mailto:pijus@visionary.lt)

## Agnė Paliokaitė

Visionary Analytics  
M.Valančiaus 1A, 03155 Vilnius, Lithuania  
[agne@visionary.lt](mailto:agne@visionary.lt)

## Žilvinas Martinaitis

Visionary Analytics  
M.Valančiaus 1A, 03155 Vilnius, Lithuania  
[zilvinas@visionary.lt](mailto:zilvinas@visionary.lt)

## Marek Tiits

Institute of Baltic Studies  
Lai 30, 51005 Tartu, Estonia  
[marek@ibs.ee](mailto:marek@ibs.ee)

**Abstract:** The paper outlines a conceptual model behind the proposition that firms' position in global value chains (GVCs) affects actual skills of the labour force and innovation activities. The proposed approach rests in particular on a concept of absorptive capacity and a distinction between potential to act and actually realised skills that employees use at their workplace. The paper contributes to scholarly literature by linking skills, participation in GVCs and innovation. This helps improve the current understanding of the role that GVCs play in overcoming the regional innovation paradox. The resulting model provides potentially fruitful fields for empirical research and enables moving to higher constraint research designs. Although Central Eastern Europe is the context for the framework, its implications are applicable to latecomer and catching-up economies more widely.

**Keywords:** regional innovation paradox; global value chains; absorptive capacity; skills; innovation.

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**Biographical notes.** Pijus Krūminas is a researcher at Visionary Analytics and is currently a PhD candidate in economics at ISM University of Management and Economics. His dissertation covers the impact of innovation policy on economic growth.

Dr. Agnė Paliokaitė is a Founding Partner and Director of the private research institute Visionary Analytics, based in Lithuania. She has a Ph.D. degree in Strategic Management awarded by the ISM University of Management and Economics. Her research interests are: innovation systems; technology and innovation policies; technological upgrading and value chains; R&D and innovation networks; innovation dynamics in business; foresight and long-term strategies.

Dr. Žilvinas Martinaitis is a Founding Partner and Research Manager at Visionary Analytics. Thematically his work focuses on education, research and innovation, labour market and social policies, methodologically on indicators systems and research methods. He holds an MSc from London School of Economics and a PhD from Vilnius University where he is a part-time assoc. prof., teaching Research design and Education and research policy analysis.

Dr Marek Tiits is chairman of the board of the Institute of Baltic Studies. His particular fields of expertise are technology governance and development economics. For past 15 years he has been holding different national and international expert and advisory positions, among the others, with the Prime Minister of Estonia, European Commission and UNCTAD.

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**Abstract:** The paper outlines a conceptual model behind the proposition that firms' position in global value chains (GVCs) affects actual skills of the labour force and innovation activities. The proposed approach rests in particular on a concept of absorptive capacity and a distinction between potential to act and actually realised skills that employees use at their workplace. The paper contributes to scholarly literature by linking skills, participation in GVCs and innovation. This helps improve the current understanding of the role that GVCs play in overcoming the regional innovation paradox and increasing development capacities. The resulting model provides potentially fruitful fields for empirical research and enables moving to higher constraint research designs. Although Central Eastern Europe serves as the background of the framework, its implications are applicable to latecomer and catching-up economies more widely.

## 1 Introduction

Countries at the middle-income level face a risk of their economic growth slowing. This is partly due to their inability to re-orientate themselves towards productivity-based growth. Although countries in Central and Eastern Europe (CEE) have demonstrated high rates of economic growth, the European Bank for Reconstruction and Development (2017) still sees the region as caught in the middle-income productivity trap. Escape requires restructuring the economy towards higher value-added activities. Then economic development would be innovation- and productivity-led rather than factor-driven. Although reorientation is possible, developing countries also encounter the regional innovation paradox (Oughton et al, 2002), which limits their capabilities to increase productivity rapidly. Firms in such countries are likely to fail to exploit existing innovation opportunities fully.

Two decades after CEE countries transitioned to free market economies, researchers have not fully explained the presence of the regional innovation paradox in the CEE region. The proposed theories (e.g. endogenous growth theory, institutional quality, or varieties of capitalism) do not fully reflect the situation. Our approach combines three strands of literature discussing the middle-income trap, regional innovation paradox, and global value chains (GVCs).

The research question is as follows: how can participation and upgrading in GVCs help countries become more innovative and escape the middle-income trap? We aim to show how participation and upgrading in GVCs can lead to increased innovativeness, helping to overcome the regional innovation paradox, improving the prospects of structural change in the economy and increasing the chances to escape the middle-income trap. The key proposition of this paper is that firms' positions in GVCs determine the actual competences of employees and firms' incentives to innovate. The proposition is based on the concepts of absorptive capacities and upgrading, which is here defined as a strategy to augment the per-unit value of products (product upgrading), increase the efficiency of production processes (process upgrading), implement transition to new functions in the chain (functional upgrading) or the entry into new sectors (i.e. inter-sectoral upgrading) (Morrison et al, 2008).

Existing research lacks discussion on connections between all three elements: firm positions in GVCs in particular sectors, competences of the employees and innovation. Yet, this area of research is promising, as the separate elements of the hypotheses have already been studied. Timmer et al., (2014) and Giuliani et al. (2005) found that positions in GVCs are closely connected to skills (measured by educational attainment). Evidence of the relationship between firms' innovation activities and positions in GVCs was found by Amador & Cabral (2014), Morrison et al. (2008) among others. In the context of CEE, separate variables were studied, but relationships between variables were not studied systematically. Hence, the key purpose of this paper is to propose a conceptual model of the relationships between the key and context variables in the study: firms' position in GVCs, skills of the labour force, and innovation activities.

The rest of the paper is organized in four sections. Section 2 presents the existing explanations of the middle-income trap in the CEE context. Section 3 introduces the concept of GVCs and discusses positions and upgrading in them. Section 4 describes the hypothesised effects that GVCs have on skills and innovation. An integrative conceptual model and refined econometric model are presented and the measures of key variables proposed. Section 5 summarizes key conclusions and implications of research.

## **2. Regional innovation paradox and the role of absorptive capacity**

### *2.1 Regional innovation paradox*

Already since mid-20<sup>th</sup> century, economists have noted that countries can enter economic equilibria at low or medium income levels (Nelson, 1956; Leibenstein 1962; Bowles, Durlauf & Hoff, 2006). When entering such equilibrium (or trap), an economy manages to reach certain income per capita level but then stagnates or experiences lower growth rate. One of the stages when such growth-impeding traps emerge is the middle-income level. It manifests when countries base their growth on accumulation of factors of growth, namely, labour and capital, rather than productivity (Gill, Kharas & Bhattachali, 2007). Factor accumulation strategy works well to escape the low-income stage and enter the middle-income level, because it increases the scale of production and may attract investment from multinational firms. However, such approach stops working at a certain stage of development, when returns on the factors of production decrease (e.g. due to rising labour costs). Then, economic restructuring towards productivity-led growth must replace it (Gill et al., 2007).

Restructuring of an economy towards increased productivity closely relates to innovation capacities. However, less advanced countries fail to exploit innovation opportunities fully due to the so called regional innovation paradox (Oughton et al, 2002; Muscio et al, 2015). On the one hand, less developed regions need more investment to stimulate innovation activities. On the other hand, they lack capacities to absorb investments, when they are available (Oughton, et al, 2002). Even with increased investments, innovation outputs will be limited.

There are several competing theoretical arguments as to why regional innovation paradox exists, but none of them is satisfying. First, the *endogenous growth theory* postulates the need for investment in R&D and human capital for the economy to become more productive (Romer, 1990; Jones, 1995). We should expect so see breakthrough in region's innovation and catching up process between the CEE and Western European countries, or at least a fast and steady grow. First, although the starting position of the CEE was relatively poor, soon the investment in R&D increased. It was partly driven by the availability of the European funds. Second, tertiary education attainment in CEE countries is high. Therefore, human capital should suffice for innovation. High educational attainment and increased public investments in R&D should lead to the smaller gap in innovation outputs between the new and the old EU Member States. Empirical analysis indicates that this is not the case. Although compared to

initial positions CEE countries got closer to the Western states, they fail to converge rapidly (Veugelers, 2017). Analysis by the European Bank for Reconstruction and Development (2017) also points to the problems of the productivity growth in the region. This is especially apparent in the period after 2008, when EU investments in R&D were significant.

Second, the existing *institutions may be little compatible*, creating sub-optimal outcomes, as varieties of capitalism approach suggests (Bohle & Greskovits, 2012). However, the analysis of institutional compatibility is also insufficient to explain lag experienced by the CEE countries. As demonstrated in literature, the region shows a wide variety of capitalist institutions, meaning that different approaches have been tested (Norkus, 2008; 2012). Arguably, the most successful countries in the region (Estonia and Slovenia) have different institutional setups. This also lends support to there being no single institutional solution. Therefore, there is no one-size-fits-all approach when it comes to the role of institutions in improving economic development in the CEE countries.

Third, *institutions may be ineffective* due to favouring societal benefits over individual gain (Pritchett, 2001). This could lead to inability to optimise an innovation system to reward those economic agents that contribute to common welfare. Pritchett (2001) notices that increase in educational attainment does not necessarily mean increase in labour productivity. Based on North (1990), he argues that institutional environment may favour personal gains but be detrimental to societal welfare. In such case, more education would lead to increase in individual income but would not necessarily translate to higher total output. The argument may seem compelling. However, it is not necessarily applicable to the CEE region. For example, Doing Business Report results show that the quality of institutions in CEE is comparable to those of Western countries (World Bank, 2017a). The successful joining of the EU and OECD by many CEE countries also indicates that their institutional systems meet requirement thresholds. Therefore, it is unlikely that institutional environment is greatly detrimental to developing the economy.

The fourth potential explanation is in the *industrial structure*. Moncada-Paternò-Castello et al. (2010) note that the US has stronger sectoral specialisation than the EU. This leads to higher R&D-intensity in the private sector in the US compared to the EU. The conclusion is that differences in R&D are determined by structural differences of economies rather than other factors. This should be even more the case in CEE countries, where the most R&D-intensive industries are little developed. This would mean that the regional innovation paradox is not so much about innovation as about dominant industries.

However, if the Moncada-Paternò-Castello et al. (2010) argument is valid, there are two important aspects to take into account:

- Recent studies of the effectiveness of the European structural funds show that their effect on innovativeness is limited (Reid et al., 2015).
- Even if low innovation capacities are driven by economic structure, the need to transform economies towards productivity-oriented remains relevant.

There are potential explanations of the regional innovation paradox in the CEE region, but they fail to fully account for the observed trends or fail to propose remedies. Therefore, additional research is needed to account for the persistence of the regional innovation paradox in CEE countries.

## 2.2. Absorptive capacities: use and acquisition of knowledge

Drawing from the evolutionary economics and the technological capabilities approach (Nelson and Winter, 1982) that intentionally looks at developing countries and formulates a theory of innovation and learning, we propose that countries face two main problems, when willing to restructure their economies into productivity-based. First, firms must be able to exploit existing knowledge and turn it into commercial outputs. Second, firms must obtain

new knowledge to remain competitive and be able to expand the scope of their production rather than scale. The following parts briefly discuss both of these aspects, laying ground for further discussion.

One potential explanation of CEE region's lagging is that despite innovation-friendly developments, economic entities are not ready to exploit new opportunities. Although financial resources are available and the environment is suitable, firms themselves may lack capacities needed to absorb knowledge and transform it into commercially viable innovations. For example, Muscio et al (2015) provide evidence on the 'regional innovation paradox' in CEE countries claiming that CEE innovation systems have reached a ceiling in terms of their capacity to absorb public financial investments in research and innovation, notably due to the limited human and financial capacities of indigenous smaller firms. Hence, pumping more investments is unlikely to lead to the expected returns due to low absorptive capacity.

Studies have defined absorptive capacity of firms in two main ways (Zahra & George, 2002, p. 198), either as:

- 'A firm's ability to value, assimilate, and apply information toward commercial ends' or as
- '[An] emphasis on acquiring and exploiting externally generated knowledge'.

Zahra & George (2002, p. 198) go further to update these definitions by including 'organisational routines and strategic processes', as well as 'exploit[ing] new knowledge by transforming acquired knowledge'. Thus, absorptive capacity reflects the inner capabilities of a firm to seek new knowledge and adapt it according to its needs. It reflects many aspects of firms, such as routines, knowledge sources, etc. (Zahra & George, 2002).

Researchers who follow the absorptive capacities approach tend to agree that firm's capability to exploit knowledge directly affects the amount of value it creates. If a firm is willing to increase the value added of its activities, it must be capable to absorb and exploit new knowledge. This also shows that overcoming regional innovation paradox (improving innovation capabilities through building absorptive capacities) can help countries escape the middle-income trap (higher value-added activities leading to higher income).

Furthermore, the recognition and exploitation of valuable knowledge is subject to knowledge previously acquired at the firm, giving this process an accumulative (path dependency) character. Cohen and Levinthal (1990) suggest that success is influenced by the stock of knowledge accumulated within a firm, embodied by skilled human resources and accrued through in-house learning efforts – its prior knowledge base. In-house R&D activities and highly educated personnel are often perceived as the most effective ways to absorb external knowledge and are often used as a measure of knowledge base. However, skills are usually developed through training in workplace and practical experience. For example, Guliani and Bell (2005) measure knowledge accumulated within a firm as a number of technically qualified personnel in the enterprise, their level of education and training, their experience in terms of time in the industry, and the number of other enterprises in which they had been employed.

In addition to being capable to absorb and exploit knowledge, firms must be able access to it. They may either adopt existing knowledge or create new knowledge. In the first case, any potential sources for knowledge transfer may serve. In the second case, firms must have enough capacities to carry out needed research themselves. Even when firms create new knowledge, they must be able to commercialise products. To achieve this, firms must forge links with potential buyers, especially if their product is not yet ready for market. Participation in value chains enables this. It also allows firms to outsource some of the lower value-added activities to other domestic or foreign companies, thus optimising their operations.

Given this, participation in GVCs serves as both the channel of knowledge new to a firm, and the motivator to focus on higher value-added activities. Together with high absorptive

capacity, GVC participation should help firms transition from factor- to productivity-based activities. This would enable upgrading at sector and country levels. For example, Szalavetz (2014) found that GVC-integration is the key factor driving knowledge-based upgrading in Hungary.

Although literature on middle-income trap references GVCs relatively rarely, recently the connections started receiving increasing attention (Engel & Taglioni, 2017; World Bank, 2017b). Literature also shows that participation in GVCs helps countries improve their development across various income levels (Kummritz, Taglioni & Winkler, 2016). As discussed in detail below, GVC approach can indicate ways to overcome the middle-income trap and regional innovation paradox.

### 3. Global value chains

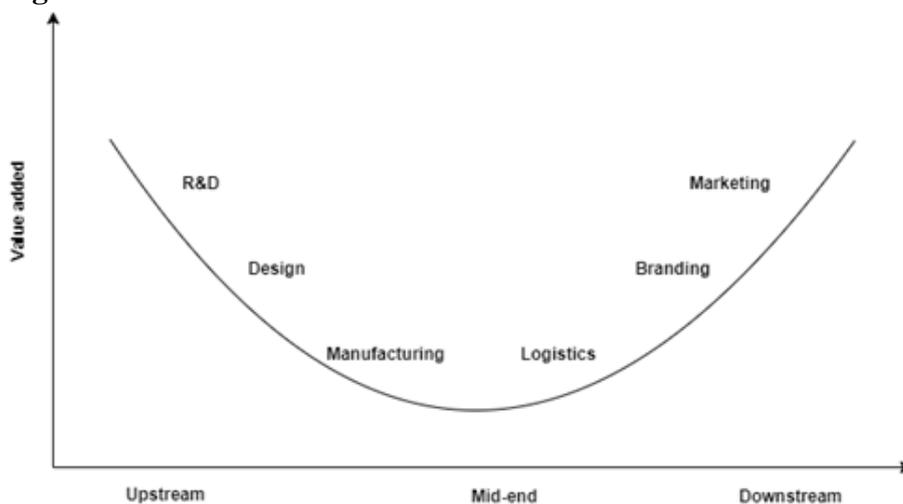
#### 3.1. Implications of firm's position in a GVC

Literature on GVCs draws heavily from the industrial organisation theory with the value chains approach (Engel & Taglioni, 2017). The difference lies in the focus. The standard value chains approach focuses on local markets, while research on GVCs looks at regional and global markets.

A value chain is 'the full range of activities that firms and workers perform to bring a product from its conception to end use and beyond' (Gereffi & Fernandez-Stark, 2011, p. 4). Participation in a value chain relies on the competitive advantage in that specific position relative to other local firms (Hernández & Pedersen, 2017). Likewise, a GVC provides similar competitive advantage at the global level. If a firm enters a GVC at an assembly section, it is so because it has an advantage in assembly compared to firms in other countries. If it performs R&D for a product in a GVC, then these activities form its advantage over firms in other countries.

Structural representation of a GVC helps to identify how different types of participation relate to created value. GVCs are usually conceptualised as 'smiley' curves (Kowalski et al, 2015; Mudambi, 2008), because value added is high at the beginning and at the end of a GVC, but low in the middle. The initial stages are R&D and innovation activities, while firms at the end of a chain carry out marketing and branding. Firms located at the centre of a GVC create the least value added, mostly due to engaging in low productivity activities, such as manufacturing or assembly.

**Figure 1. Structure of GVC**



Source: adapted from Mudambi (2008).

Since countries at risk of the middle-income trap are exploiting factor-based competitive advantages (mainly, cheap labour), firms are likely to enter GVCs, where cheap resources are needed (Gill & Kharas, 2015). In this case, it is the mid-end with activities, such as manufacturing and logistics (Hernández & Pedersen, 2017). As long as firms keep this advantage, they have few incentives to move downstream or upstream, even if it would lead to higher value added (see discussion below). The costs of transition would be high, and required human capital might be difficult to obtain.

Multinational enterprises (MNEs) are willing to outsource some of the activities to foreign countries, where such work is cheaper. Both local MNEs and local firms have incentives to exploit low labour costs:

- For the MNE it is worth outsourcing activities that create little value and are cheaper to implement elsewhere (reducing operational costs).
- For local firms, getting involved in the mid-end of a GVC provides opportunities to increase turnover by exploiting availability of cheap labour force.

Favourable conditions to mid-end involvement limit local companies' incentives to upgrade. They can generate revenue by exploiting their main competitive advantage – cheap labour – and initially have no need to rely on alternative strategies. Therefore, the risk of slowing growth is high for countries, where low labour cost is one of the main competitive advantages.

With the development of country's economy, factor costs increase and profit diminishes, leading to decreasing growth rates (Gill & Kharas, 2015). However, even under such conditions transition to productivity upgrade may remain difficult because firms may remain locked in low value added activities.

Employers' investment decisions can explain such lock-in, although upgrading seems to be a suitable strategy in the long term. When considering investment, employers may choose between strengthening human capital and upgrading firm's equipment. If an employer mainly relies on cheap labour for participating in GVCs, investing in human capital is an unlikely decision. Even though firms may understand that their main choice lies between upgrading and perishing, it does not necessarily mean that they will be able to increase their absorptive capacity enough to upgrade in GVCs. Only a small share is likely succeed (Ernst & Kim, 2002). This could imply that for other firms the choice is to exploit the existing advantage to its full extent.

We propose that improving human capital would lead to increased costs for a firm without comparable returns. The argument is as follows. If employees improve their skills, they may start demanding higher wages or looking for alternative jobs. This could diminish firm's cheap labour advantage. Furthermore, the employer does not need a more skilled workforce because tasks performed in a GVC are relatively simple and low-skilled employees suffice. Therefore, investing in human capital would either:

- Force the firm to lose its competitive advantage due to increased labour costs (no additional benefits for the firm), or
- Force the firm to replace employees with obtained higher skills with low-skilled employees to decrease labour costs. In such case, investment would not provide any positive returns to the firm.

Therefore, a firm should invest in capital goods. Investment in equipment upgrades may help it achieved larger production scale even with existing human capital due to increased efficiency. Thus, investment allows a firm to increase production without losing its main competitive advantage, cheap labour. At the same time, such strategy limits capabilities to move up the GVC. Focus on the accumulation of physical factors of production rather than on

productivity is problematic, since it distracts from moving towards productivity-based growth (World Bank, 2017b).

Such strategy would entrench firm's position in the mid-end of a GVC. It would lock itself in the low value added activities rather than upgrade its position within a GVC. Investment in human capital would enable a firm to move up the value chain with relative ease in the long term, but in the short-run, its competitive advantage would decrease. Therefore, investment in machinery and equipment seems more efficient. This reflects the knowledge embodiment in capital rather than labour. Once a firm invests in capital, it becomes more difficult for it to restructure its activities, because capital may become less relevant for the new ones. The need to change the now obsolete equipment would become sunk costs. In order not to bear them, the company may lock-in. In addition, the lack of easily accessible skilled-labour may further limit firm's opportunities to engage in higher value added activities.

In the light of the discussed middle-income trap and regional innovation paradox, the implications of stalling in the mid-end of a GVC are important in the following ways:

- If firms get involved in mid-end activities, they create little value, and profits diminish when factor costs increase.
- If firms mainly rely on factors of production, they may lack incentives or capabilities to upgrade in a GVC.
- If firms implement mid-end activities, they do not need to develop human capital because they do not aim to get involved in knowledge transformation. Rather, they focus on increasing the scale or efficiency of existing activities.

Firms implementing mid-end activities would also require change in their business strategy. The change would have to be radical and this may further strengthen the lock-in of a firm in the mid-end. The structure of some GVC-intensive sectors (e.g. automotive) is such, that upgrading requires finding/carving, new niches where the competitive advantage could be realised. It would also allow capturing the 'control' of a GVC, maximising the benefits. The creation of a new niche also requires high capacities of a firm either to utilise the emerging disruptive technologies or to enter the production of new products. If they are not available, a firm remains locked-in.

The outlined argument suggests the following propositions:

- Firms in the mid-end of a GVC expand human capital by hiring more employees rather than investing in higher skills, due to the labour-intensive nature of activity.
- Investment in capital goods should cover a larger share of firm's total investment if it is located in the mid-end of a GVC compared to firms in upstream and downstream activities.
- Mid-end firms with higher investment in capital are more likely to remain locked in the same position.
- Employees of mid-end firms have lower skills than employees of firms in upstream and downstream positions and receive less training.

These arguments illustrate how position in GVCs may consolidate the status quo. Since firms fail to develop absorptive capacities, their chances to upgrade remain limited. If a significant share of firms remains in the mid-end, the country may be stuck in the middle-income trap. Therefore, it is important to understand what factors may affect firm's capabilities to upgrade positively.

### *3.2. Upgrading in GVCs*

Upgrading in GVCs is a move from lower- to higher-value added activities. Humphrey and Schmitz (2002) and Giuliani et al (2005) discuss the four types of upgrading options. Process

upgrading refers to transforming inputs into outputs more efficiently by reorganizing the production system. Product upgrading means moving into higher value-added product lines, while functional upgrading refers to acquiring new, superior functions in the chain, such as design or marketing, and intersectoral upgrading means applying the competence acquired in a particular function to move into a new sector.

The concept is applicable at various levels – national, sectoral, firm, and employee (Gereffi et al., 2005). Upgrades at different levels are mutually dependent. Therefore, capacity to upgrade position in a GVC depends on the lowest level, i.e. employees' ability to increase their productivity. While it is not the only important factor, it is a necessary condition. Taglioni and Winkler (2016) propose a three-level structure of upgrading. At the first level, tasks must be upgraded. They depend on existing skills, capabilities, and comparative advantage of a firm. At the second level, growth of value-added must be achieved. This requires upgrades in capital, skills, and processes. As a result, the third level, high value-added production, is achieved accompanied by functional, intersectoral, and product upgrading. Thus, upgrading in a GVC is a complex process consisting of several interlinked steps.

Participation in GVCs promotes countries' development irrespective of their income level (Kummritz et al., 2016) due to knowledge and technology spillovers. However, merely joining GVCs does not guarantee upgrading. An economy might remain stuck in low value activities without functional upgrading. Studies show that there is potential by developing countries to get involved in GVCs (Pananond, 2013), but they may remain at the mid-end, as discussed in section 3.1. One important conclusion by Giuliani et al (2005) is that process or product upgrading has been occurring to a certain extent, but functional and intersectoral upgrading are rare.

To complicate things further, technologies that drive the fragmentation and globalization of production networks develop rapidly and reshape the global patterns of investment and skills demands. With routine tasks rapidly being computerized, the traditional model of GVC integration, with entry in labour intensive, low-skilled activities (such as assembly), and a gradual shift to higher-skilled activities (including services), may become less viable.

An alternative theoretical framework is the 'catch-up cycle' theory (Lee and Malerba, 2017). It acknowledges the possibility and reality that latecomer firms and industries may take the leadership of sectors by creating their own value chains. This view is consistent with an observation made by Amsden and Chu (2003) that a form of national ownership is needed eventually to build local value chains. Lee, Shapiro and Mao (2017) present the 'in-out-in-again' hypothesis. According to it, during the initial stage of growth, more participation in the GVC is desirable, because it helps to learn from the outside. Functional upgrading requires some effort during the middle stage, as well as separation and independence from existing foreign-dominated GVCs. Finally, firms and economies might have to seek further opening to integrate back into the GVC after establishing their own local value chains during the advanced stage. The foreign value added trends in successful catching-up economies, such as South Korea, Taiwan, and China, are shown to be consistent with the 'in-out-in again' explanation.

Many factors are important in determining potential for upgrading. They include skills, standards, business climate, institutions, policy, labour market, structure of a GVC and particular sector, and many others (Engel & Taglioni, 2017; Hernández & Pedersen, 2017). The drivers of upgrading fall into two categories:

- Firm-level factors that affect firm's capabilities (e.g. skills of employees, firm's routines, etc.)
- Sector/ country-level factors that affect firms' upgrading capabilities (e.g. skilled labour supply, business environment, etc.).

Absorptive capacity would fall into the first category, as it defines firm's readiness to exploit knowledge. Factors external to a firm still play a secondary role because the firm will not be able to benefit without increased absorptive capacity. For example, Yoruk (2013) shows that learning by doing and learning by exporting do not have statistically significant effect on functional upgrading in Eastern Europe. She shows that opportunities offered by GVCs will be of little use unless firms have ability to internalise this external knowledge through its human resources, through training and research within the firm. However, when absorptive capacity increases, firm's position in a GVC could upgrade due to its improved ability to exploit knowledge. Sector and country level factors may accelerate or slow down this process.

This bears implications for overcoming the regional innovation paradox. Once absorptive capacities increase, firms can upgrade in GVCs. Moving up a GVC allows a firm to carry out activities more closely related to innovation, and begin outsourcing low value added activities to other firms. The firm with improved absorptive capacity has higher potential for innovation activities. Thus, increased absorptive capacity allows firms to upgrade in a GVC, carry out more innovation activities and even consider the 'in-out-in again' route. However, aggregate innovation output also depends on the absorptive capacities of non-GVC firms, since they can innovate as well, if they acquire knowledge from sources other than GVCs.

To summarise, the higher up a firm is in a GVC, the more it innovates. This can be aggregated to higher, e.g., sector, levels. When more companies join GVCs at higher positions, the whole sector becomes more innovative and positive spillovers among firms are possible (Taglioni & Winkler, 2016). In order to upgrade firms' positions, they must first increase their absorptive capacity. Literature stresses that it partly depends on knowledge already accumulated in human capital, including the skills of employees and R&D personnel (Minbaeva et al, 2014; Zahra & George, 2002; Glass & Saggi, 1998). Therefore, in order to increase absorptive capacity, firms must improve the skills of their current employees or find highly skilled replacements.

#### **4. The proposed conceptual model: skills, innovations and firm positions in GVCs**

In the light of the regional innovation paradox, it is worth theorising relationships between absorptive capacity, participation in GVCs, and innovation. Such model also has policy implications. Despite research on separate constructs, a joint-model does not exist, to the best knowledge of the authors. The following sections start with providing a theoretical framework to separate hypothesised relationships and finalise with a merged model.

##### *4.1 Skills and GVCs*

As theorised above, qualifications of employees are lower in mid-end firms than in firms found at the beginning and end of GVCs. Firms lack incentives to provide additional training to their employees when conducting low value-added activities. Therefore, there are no incentives for firms to improve their absorptive capacities significantly, and opportunities for upgrading remain limited. In order to increase absorptive capacity, firms must also focus on employees' skills.

Skills that employees actually use at the workplace are particularly important. The approach to measuring skills proposed by Martinaitis (2014) rests on a distinction between potential to act and actually realised skills. The former is typically captured by past experience, obtained education and training. This, however, does not signify the skills of an individual *per se*, since potential may or may not be utilised. It depends on tasks, technology, work organisation practices (Levin 1987), and other factors related to performance domain. If potential to act remains unrealised, the observed level of skills (i.e. the quality of performance

of a task) is low. Conversely, an individual using complex procedures for acquiring and working with information should be considered highly skilled, irrespective of previous experience or the type of education attained.

Such approach is a better proxy for employees' skills and firm's absorptive capacity than employees' education. Taglioni and Winkler (2016) also suggest that the first-level upgrade in a GVC is upgrading of tasks. Thus, we propose that skills actually used at the workplace play the primary role. Required tasks may also change with the routines and other characteristics of firms, thus, strengthening the connection with absorptive capacity.

The relationship between skills and position in GVCs appears to be bidirectional. It is clear that firms need higher absorptive capacity and employees with higher skills in order to upgrade and implement new and more difficult tasks. However, upgrading also helps to improve the skills of the workforce (Cattaneo et al, 2013). On the one hand, firms need qualified labour force to carry out activities that create higher value (Kaplinsky & Morris, 2000). Firms willing to upgrade their positions in GVCs also need to invest in strengthening the skills of their employees (Gereffi et al, 2011).

On the other hand, once a firm's position upgrades, it still needs to keep employees' skills at a specific level to remain competitive in that particular GVC position (Cattaneo et al, 2013). Employees must use skills to keep them relevant and fit, and receive training to strengthen their capacities to perform required activities. Changes in skills used at work affect the absorptive capacity of a company and its position in a GVC. However, it also changes skills required from employees via: 1) transforming working environment (including more demanding tasks); 2) improved in-house training to strengthen employees' potential. Thus, the direction of effects may be difficult to unravel. Table 1 below identifies the effects that GVC participation has on skills.

**Table 1. Links between GVC participation on skills**

Hypothesised effects and their relevance	Factors	Effects
Demand effect. GVC participation leads to increased demand for higher-skilled labour. Demand for skilled labour should lead to higher requirements for actually used skills.	GVC position	Skills actually used
Training effect. Participation in GVCs increases the amount of training provided by a firm to its employees, since new tasks, processes, etc. are introduced.	GVC position	In-house training
Labour turnover effect. Knowledge received by employees is likely to diffuse in the market, once they change their employers. The now-skilled employees, who move to other domestic firms, carry their skills and expertise.	GVC position	Previous work experience
Task effect. Higher GVC positions create more challenging tasks for employees. This increases requirements for employees' actual use of skills.	GVC position	Work environment
In-house effect. Training strengthens employees' skill potential. New training at workplace should improve employees' performance potential but it does not mean that the skills will be used at work.	In-house training	Potential
Education effect. Education institutions provide the basis for skills and competences required for work. Thus, they contribute to the potential to carry out tasks at a workplace.	Education attainment	Potential
Experience effect. Skills used in previous workplaces affect employee's potential to perform tasks in a new workplace.	Previous work experience	Potential
Potential effect. The potential of employee defines what tasks he is able to perform. Therefore, the higher the potential, the more challenging tasks are accessible to an employee.	Employee's potential	Skills actually used
Environment effect. The more challenging tasks must be performed, the more advanced skills an employee uses.	Work environment	Skills actually used
Skills effect. Actual skills used at a workplace improve	Skills actually used	Absorptive

Hypothesised effects and their relevance	Factors	Effects
capabilities of a firm to use knowledge, increasing its absorptive capacity.		capacity
Absorption effect. When the absorption capacity of a firm increases, it can use new knowledge and innovate. These activities create higher value added, and push the firm up the value chain. Therefore, higher absorptive capacity should lead to higher positions in GVCs.	Absorptive capacity	GVC position

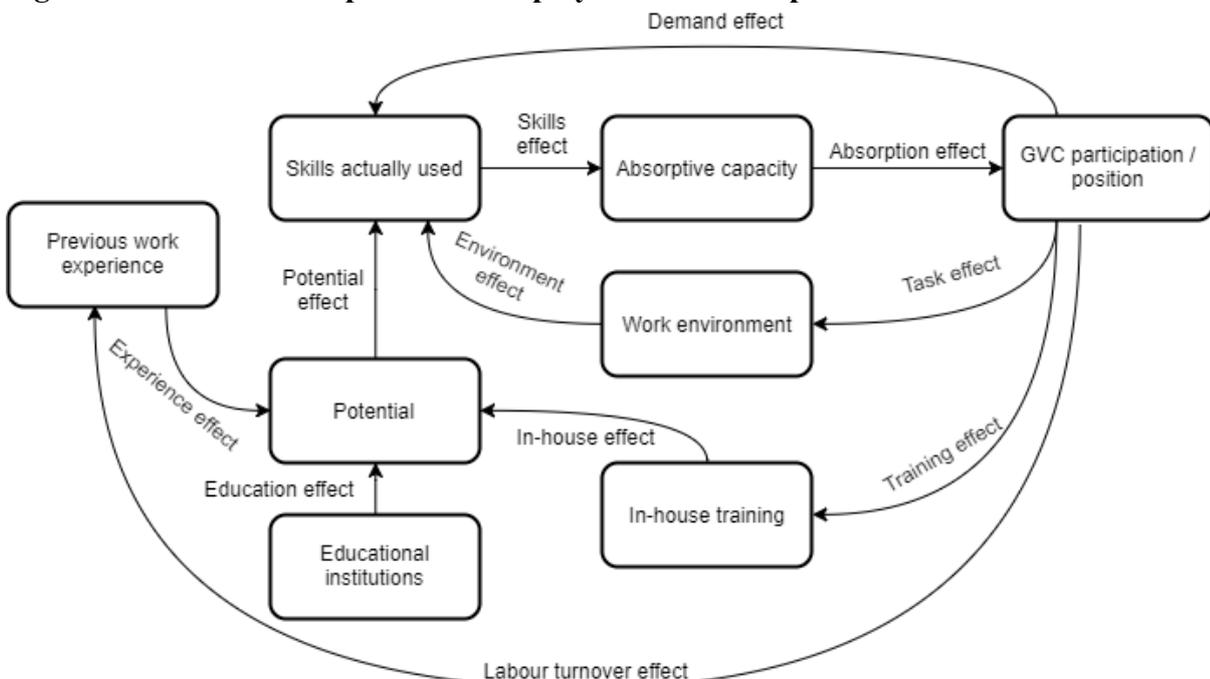
Source: own elaboration, partly based on Taglioni and Winkler (2016)

Effects running in the opposing directions pose a challenge when identifying the impact of skills on upgrading in GVCs. A potential solution to such endogeneity could come from distinguishing between external and internal skills provision. The former is strongly associated with national institutions (Ramirez & Rainbird, 2010). Without necessary educational attainment provided by the education system, labour force may not be fit to perform upstream or downstream activities. However, educational institutions directly affect only the potential of the workforce but not the skills required at workplace. As firms cannot directly influence skills supplied by external agents, educational institutions indirectly affect position in GVCs but not vice-versa.

A clear distinction is not always possible. For example, it is more difficult to disentangle internal skills provision, because it may take place either due to GVC participation or without GVCs playing a role. Firms may feel pressure to improve their human capital even without foreign partners. Meanwhile, in-house training is likely to be associated with the difficulty of tasks that an employer gives to a specific employee. Therefore, it should affect firm's capabilities to upgrade in a GVC via improved potential. On the other hand, developing skills through changed tasks (with increased difficulty) results from improvements in GVC position.

Figure 2 below shows the theorised links between skills and GVC participation. It portrays both directions of the relationship between skill-related factors and position in GVCs, including likely feedback links.

**Figure 2. The relationship between employees' skills and position in GVC**



Source: own elaboration, partly based on Taglioni and Winkler (2016)

Note: to simplify the model, factors unrelated to skills but influencing absorptive capacity and GVC participation or position have not been included.

The proposed model outlines the expected impact of skills on positions in GVCs, and the effects of such upgrading on provision of skills. In order to understand how this may help overcome the regional innovation paradox, the following section discusses how changes in firms' GVC position may alter their innovativeness.

#### *4.2 Position in GVCs and innovation*

Participation in GVCs closely relates to innovation. In fact, literature on GVCs provides rich empirical evidence about how firms, clusters, and regions learn and innovate because of their involvement in GVCs (e.g. De Marchi et al (2016) analyse 114 sources on GVCs and innovation in developing countries). Researchers note that links between foreign and local economic agents facilitate knowledge transfer, which increases capabilities of local firms to innovate. For example, foreign direct investment is one of such mechanisms (Fagerberg et al, 2010; Fagerberg et al, 2017). Participation in GVCs enables cooperation with international partners, which improves access to knowledge. Therefore, it is reasonable to expect that participation in GVCs should help make innovation activities more intense through increased pool of available knowledge.

When a firm increases its absorptive capacity, it also increases its potential to carry out innovation activities. Although at the mid-end the main benefits are production-based, innovation intensifies higher in the chain. Once higher up in a GVC (especially, in the upstream section), the firm has more opportunities to benefit from innovation due to links with activities higher up in the chain (i.e. collaborating firms use innovation outputs). Therefore, participation and upgrading in GVCs should facilitate overcoming the regional innovation paradox and escaping the middle-income trap.

There is an important distinction between production and innovation (Lema et al, 2015). Firms may generate revenue solely from production without innovating. Value added of such activities would be low but firms may increase their revenue from expanding their scale. Innovation, on the other hand, increases revenue through increased productivity. If more sector's firms become innovative and base their development on productivity growth, the sector develops faster. At a larger scale, this helps to advance structural change in the economy, increasing the share of companies that focus on productivity-led growth.

Firms in developed countries implement activities at higher positions of the value chain. The leading firms largely control knowledge transfer due to the controlled nature of GVCs (Gereffi et al, 2005). Therefore, they may limit the type and the amount of knowledge that firms receive at lower levels. Thus, companies at higher sections of a GVC may also affect the intensity of knowledge transfer. This may affect the impact of GVC-participation on innovation.

Taglioni and Winkler (2016) identify several mechanisms through which participation in GVCs helps develop country's economy. Table 2 below provides their assessment in the light of relevance for innovation and productivity-led growth. This helps identify the routes through which GVC participation affects innovation.

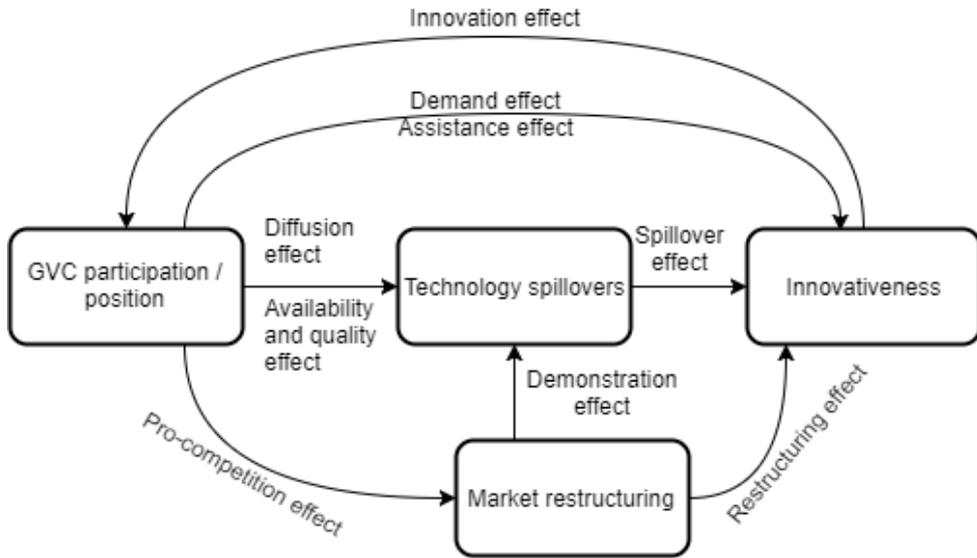
**Table 2. Links between GVC position and innovation**

<b>Hypothesised effects and their relevance</b>	<b>Factor</b>	<b>Effect</b>
Demand effect. GVC participation increases demand for higher quality inputs from local suppliers. Increase in demand for high-quality inputs may encourage local companies to improve their products due to higher competition. Therefore, the sector should become more innovative.	GVC participation	Innovativeness
Assistance effect. Assistance to local suppliers helps domestic firms obtain and use knowledge.	GVC participation	Innovativeness
Diffusion effect. Assistance effect creates the diffusion of knowledge in the suppliers' industry. Domestic firms start using the newly available knowledge, leading to innovation.	GVC participation	Technology spillovers
Availability and quality effects. More and higher quality inputs become available in the buyer's industry. Domestic firms may utilise the newly available inputs and use them to improve their own products.	GVC participation	Technology spillovers
Pro-competition effect. Competition for resources increases, when participation in GVCs increases, leading to improvements in productivity. Higher competition demands increased productivity, meaning stronger pressures to innovate.	GVC participation	Market restructuring
Demonstration effect. Imitation helps adopt knowledge. Increased availability of products (or services, processes, etc.) created through GVCs or used by participating firms allows domestic firms to imitate.	Market restructuring	Technology spillovers
Restructuring effect. Due to increased pressures to innovate, the market restructures, favouring more firms that can exploit knowledge. This leads to higher survival rate of innovation-friendly firms, making the whole sector/economy more innovative.	Market restructuring	Innovativeness
Spillover effect. Technology spillovers enable more domestic firms (both within and outside GVCs) to use knowledge to innovate.	Technology spillovers	Innovativeness
Innovation effect. When a firm becomes more innovative, it increases its chances in moving up in a GVC (including 'in-out-in again' route) due to increased advantage at the upstream.	Innovativeness	GVC position

Source: based on Taglioni and Winkler (2016).

The influence of participation and upgrading in GVCs should be noticeable due to the many mechanisms through which effects might emerge. However, as in the case of skills, the effect may also run in the opposite direction. When firm's innovativeness increases, it is more likely, that it will be able to either 1) upgrade its position due to increased advantage in innovation activities; or 2) leave a GVC due to lost competitive advantage of cheap labour. Figure 3 below depicts the theorised relationships between GVC participation and innovativeness. The key element here is that there is an expected feedback loop, where innovativeness affects GVC participation/ position.

**Figure 3. The interaction between GVC participation and innovativeness**

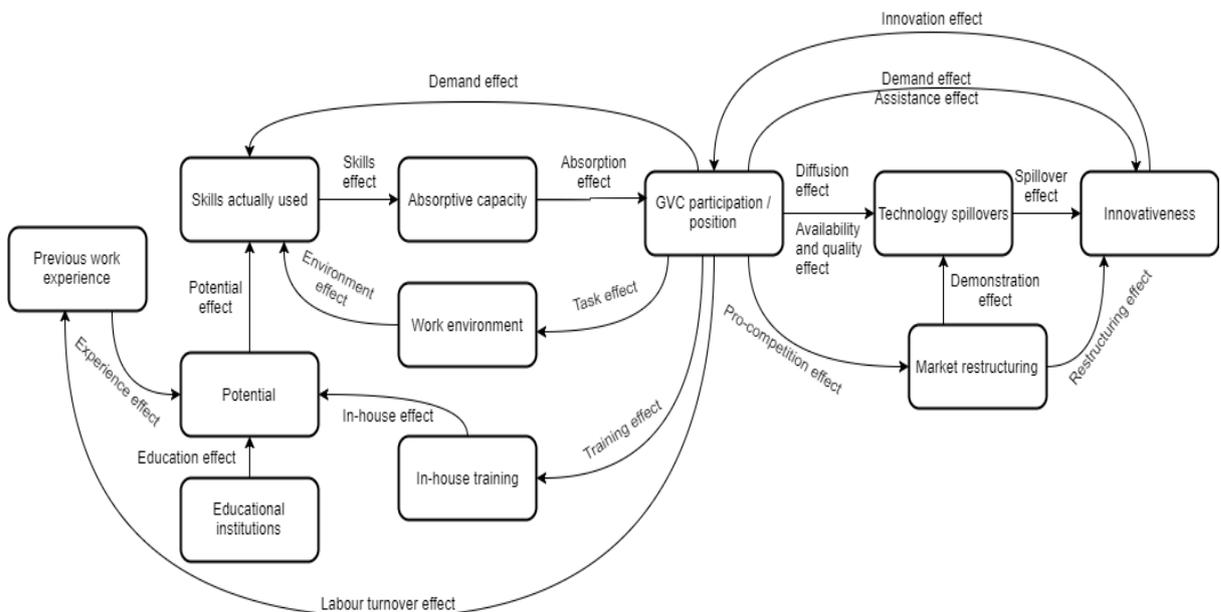


Source: partly based on Taglioni and Winkler (2016).

*4.3 Skills, participation in GVCs and innovation: a merged model*

Following the discussion on skills, participation and positions in GVCs, and innovativeness, the outlined relationships are further specified in a single framework. Although other factors<sup>1</sup> may play a significant role, it would defocus the model. Additional factors could be included in further research.

**Figure 4. Detailed model linking skills, GVC participation and sector-level innovativeness**



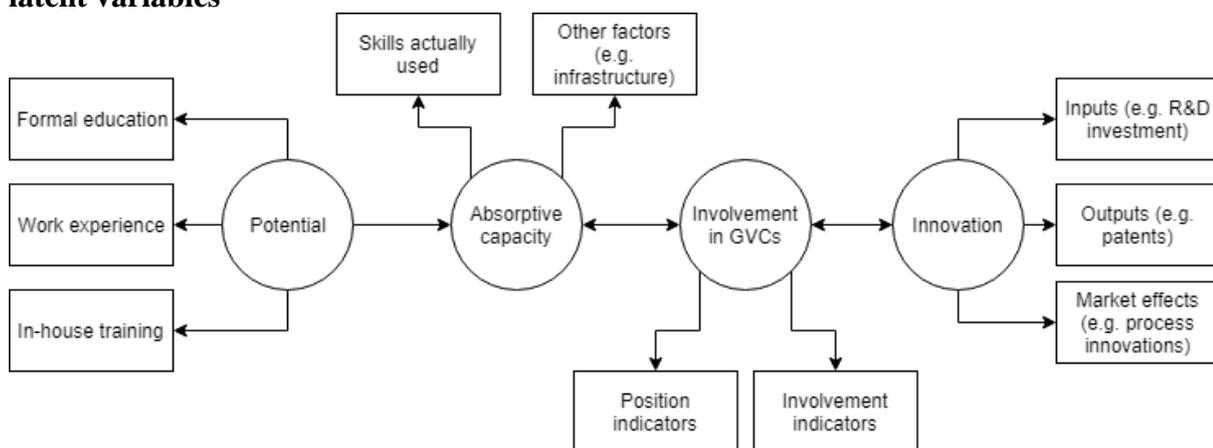
Source: own elaboration.

<sup>1</sup> Firm's absorptive capacity does not depend only on employees' skills. Other factors are routines, diversity of knowledge sources (Zahra & George, 2002), local factors affecting technology spillovers or regulatory environment, etc. However, for the purposes of the current framework we mainly focus on skills.

Several of the constructs can be simplified using the notation of structural equation models (SEM) with latent variables. This depiction provides a clearer structure to the model and helps to determine specific indicators that could be used to measure different variables. Some of the variables in the model shown in Figure 4 are not measurable directly, but are indirectly reflected in other variables. For example, in-house training, education, and previous work experience form a part of an employee's potential. Thus, SEM-like (but not fully SEM) depiction both simplifies the model and allows understanding the composition of used constructs better. The model in Figure also 5 includes potential bi-directional endogenous links between variables. Thus, it highlights the main conceptual links between the discussed phenomena.

There are differences between the structure of conceptual and SEM models. First, the model in Figure 4 is more specific in terms of how the causal effects emerge (i.e. the specific mechanisms at work). The model in Figure 5 is less specific about the mechanisms that enable effects, but clearer. Such approach allows a more simple presentation and estimation. Second, the model depicted in Figure 5 also opens the black box of previously used concepts such as GVC participation and position or innovativeness. They serve as latent variables, but can be measured indirectly through observable variables.

**Figure 5. Model linking skills, GVC participation and sector-level innovativeness with latent variables**



Source: own elaboration.

Note: circles indicate latent variables.

## 5. Discussion

From a broader perspective, the paper aimed to provide a theoretical explanation, why countries may be stuck at the middle-income level, unable to exploit innovation opportunities. It proposes an alternative explanation suggesting that the position of firms in global value chains relates to the actual level of skills and competences of employees and incentives to innovate. If firms operate at higher value-added producing positions of the GVCs, they have incentives and capabilities to invest in R&D and innovation. Their employees are constantly learning at the workplace, developing skills improving capacities to recognise and use new knowledge for creating innovation. However, if companies are at the mid-end of GVCs, they invest in more efficient equipment rather than R&D and innovation. Simple monotonic tasks destroy employees' competences acquired in the education system. Economies and sectors, characterised by 'depreciated' human capital and the lack of experience in innovation, remain 'stuck' at the bottom of GVCs (and middle-income trap). How to escape this 'trap'? The answer has both theoretical and practical implications for CEE as well as other countries in the process of global integration.

This paper sought to develop a conceptual framework capturing interrelationships between different domains (skills, GVCs, and innovation). The proposed model has several implications regarding the expected relationships between their key elements:

- The proposed approach rests on a distinction between potential to act and actually realised skills that employees use at their workplace. If potential to act remains unrealised, the observed level of skills (i.e. task performance quality), and consequently the absorptive and innovation capacity is low. In-house training, previous work experience and acquired education define employees' potential. Potential of employees mostly affects firm's absorptive capacity indirectly via the skills actually used at workplace rather than directly.
- Absorptive capacity partly depends on skills that employees actually use in the workplace.
- Firms' absorptive capacity affects GVC participation and position (upstream, mid-end, or downstream).
- GVC participation and position affect both employees' potential and skills actually used at a work place.
- GVC position (distance to final demand) and participation have an effect on firm innovativeness with higher GVC positions leading to more intense innovation activities. This should result in increased innovation inputs (from the private sector) and outputs.

The outlined model provides potentially fruitful framework for empirical research with managerial implications for firms and industries as well as policy suggestions. The integrative model represents an important step to developing testable constructs and hypotheses that could help the transition to theory testing. Although CEE provides the context, in which the framework has been developed, its implications are applicable to other transition / latecomer / catching-up economies struggling to reach an innovation-driven path for their productive structure.

The proposed conceptual model also faces several challenges and limitations. To simplify the model, a number of external factors (e.g. local factors affecting technology spill-overs, regulatory environment, aspects related to GVC governance, labour mobility, labour market rigidity, and others) have not been included. Specifics of different economic sectors (industry vs. services, varying levels of knowledge intensiveness of manufacturing and services, and long vs. short cycle of produced technologies etc.) were not considered. Additional factors could be included in future research. Further improvement and simplification of the model is needed to move to theory testing.

Future research could elaborate the main constructs following the notation of structural equation models with latent variables, provide a better structure to the model, as well as determine specific indicators that could be used to measure different variables.

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