Global Value Chain Upgrading and Business-academia Collaborations: Case Studies of Successful Innovators

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Abstract

The article links upgrading in the global value chains with the triple helix concept by focusing on business-academia collaborations that played a part in firms’ capacity to upgrade. Both are crucial for Central Eastern European countries, which face the need to restructure their economies and escape the “middle income trap”. The article asks the following research question: how can public policy encourage business-academia collaboration or other types of activities that contribute to firm upgrading? Data on four different case studies in Lithuania is analysed to answer this question. Results indicate that building endogenous technological capacity through a variety of business-university collaboration types is needed to attract higher-value foreign direct investment and facilitate intersectoral and functional global value chain upgrading. Furthermore, besides research and development, educating and training the labour force are likely to be even more powerful drivers for business-academia collaboration in Central and Eastern Europe.

Keywords

Business-academia collaboration – Central and Eastern Europe – Global value chains – Innovation policy – Upgrading
阿拉伯

تأهيل سلاسل القيمة العالمية والتعاون بين مجال الأعمال والأكاديميات: دراسات حالة للمبتكرين الناجحين

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الملخص

يربط المقال بين الارتباط في سلاسل القيمة العالمية ومعيّن المراوح الثلاثة بالتركيز على التعاون بين مجالات الأعمال والأساط الأكاديمية التي ساهمت في تحسين قدرة الشركات على الارتباط. يعد دور هذين الطرفين حاسمًا بالنسبة لبلدان أوروبا الوسطى الشرقية، التي تواجه الحاجة إلى إعادة هيكلة اقتصاداتها وتجنب "خ: الدخل المتوسط". يطرح المقال السؤال البحثي التالي: كيف يمكن للسياسة العامة أن تشجع التعاون بين مجالات الأعمال والأوساط الأكاديمية أو أنواع أخرى من الأنشطة التي تسهم في رفع مستوى الشركات؟ يجري تحليل البيانات المتعلقة بأربع دراسات حالة مختلفة في ليتوانيا للإجابة على هذا السؤال. تشير النتائج إلى أن نباه القدرات التكنولوجية المحلية من خلال مجموعة متنوعة من التعاون بين المؤسسات الاقتصادية والجامعية أمر ضروري لجلب استثمارات أجنبية مباشرة ذات قيمة أعلى ويتيح الارتباط بمستوى سلاسل القيمة العالمية بين مختلف القطاعات. علاوة على ذلك، فإن جانب البحث والتطوير، فإنه من المرجح أن يشكل تعلم وتدرّب اليد العاملة قوة دفع للتعاون بين المؤسسات الاقتصادية والأوساط الأكاديمية في أوروبا الوسطى والشرقية.

الكلمات المفتاحية

سلاسل القيمة العالمية: رقية: أوروبا الوسطى والشرقية: التعاون بين مجال الأعمال والأوساط الأكاديمية: سياسة الابتكار
Global Value Chain Upgrading and B-A Collaborations

Agnė Paliokaitė, Elžbieta Jašinskaitė and Marek Tiits

Abstract

This study links global value chain upgrading with the triple helix concept by focusing on the role of business-education collaborations in the upgrading of companies’ capabilities. This is crucial for Central and Eastern European countries, which urgently need to adjust their economies and avoid the "middle-income trap". We propose the following research question: how can public policy encourage business-education collaborations or other activities that help companies upgrade? To answer this question, we analyze the data from four case studies in Lithuania. The results show that it is necessary to build internal technological capabilities through various types of business-university cooperation, attract higher-value foreign direct investment, and promote actual and effective global value chain upgrading across industries. In addition, besides R&D, education and training of labor may be a more powerful drive for Central and Eastern European business-education cooperation.

Keywords

Global value chain, upgrading, Central and Eastern Europe, business-education collaboration, innovation policy

French

Mise à niveau de la chaîne de valeur mondiale et collaborations entre les entreprises et les universités : études de cas d’innovateurs à succès

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Résumé

L’étude fait le lien entre la mise à niveau dans les chaînes de valeur mondiales et le concept de la Triple Hélice en se concentrant sur les collaborations entre les entreprises et les universités qui ont joué un rôle dans la capacité des entreprises à se mettre à niveau. Les deux sont cruciaux pour les pays d’Europe centrale et orientale, qui sont
confrontés à la nécessité de restructurer leur économie et d’échapper au « piège du revenu intermédiaire ». L’étude répond à la question suivante: comment les politiques publiques peuvent-elles encourager la collaboration entre les entreprises et les universités ou d’autres types d’activités qui contribuent à la mise à niveau des entreprises? Les données de quatre études de cas différentes en Lithuanie sont analysées. Les résultats indiquent que le renforcement des capacités technologiques endogènes grâce à une variété de types de collaborations entre les entreprises et les universités est nécessaire pour attirer des investissements directs étrangers de plus grande valeur et faciliter la mise à niveau intersectorielle et fonctionnelle de la chaîne de valeur mondiale. En outre, en plus de la recherche-développement, l’éducation et la formation de la main-d’œuvre sont susceptibles d’être des moteurs encore plus puissants de collaboration entre les entreprises et les universités en Europe centrale et orientale.

Mots clés
chaînes de valeur mondiales – mise à niveau – Europe centrale et orientale – collaboration entreprises-universités – politique d’innovation

Portuguese
Atualização global da cadeia de valor e colaborações negócios-academias: estudos de caso de inovadores bem-sucedidos

Resumo
O artigo vincula a atualização nas cadeias globais de valor com o conceito de tríplice hélice, focando em colaborações negócios-academias que desempenharam um papel na capacidade de atualização das empresas. Ambos são cruciais para os países da Europa Central e Oriental, que enfrentam a necessidade de reestruturar suas economias e escapar da “armadilha da renda média”. O artigo faz a seguinte pergunta de pesquisa: como as políticas públicas podem incentivar a colaboração empresarial-acadêmica ou outros tipos de atividades que contribuam para a atualização firme? Os
dados de quatro diferentes estudos de caso na Lituânia são analisados para responder a essa pergunta. Os resultados indicam que a construção de capacidade tecnológica endógena através de uma variedade de tipos de colaboração entre empresas e universidades é necessária para atrair investimentos estrangeiros diretos de maior valor e facilitar a atualização da cadeia de valor global intersetorial e funcional. Além da pesquisa e desenvolvimento, educar e treinar a força de trabalho provavelmente serão ainda mais poderosos impulsionadores da colaboração empresarial-acadêmica na Europa Central e Oriental.

Palavras-chave
cadeias globais de valor – atualização – Europa Central e Oriental – colaboração negócios-academia – política de inovação

Russian
Совершенствование глобальных цепочек создания ценности и коллаборация Бизнес-Университет: практический пример успешных инноваторов.

Агне Паликайте, Элжбета Ясинскайте и Марек Тиитс

Аннотация
Настоящая статья посвящена модернизации глобальной цепи создания ценности в рамках концепции Тройной спирали с фокусом на коллаборацию Бизнеса и Университета, оказывающей влияние на способность фирмы к изменениям. И то и другое важно для стран Центральной и Восточной Европы, которые столкнулись с необходимостью реструктуризации экономики и поиска выхода из «ловушки среднего дохода». В работе решается следующий исследовательский вопрос: как общественная политика может стимулировать сотрудничество между бизнесом и университетами или другие виды активности, которые вносят вклад в модернизацию фирм? Данные наших четырех практических
примеров получены в Литве и проанализированы с целью получения ответа на этот вопрос. Результаты показывают, что строительство внутренних технологических мощностей в рамках различных партнерских проектов между бизнесом и университетом необходимо для привлечения высокодобавленных прямых инвестиций, что стимулирует модернизацию межсекторальных и функциональных глобальных цепочек создания ценности. Кроме того, помимо исследований и разработок, обучение и тренинги сотрудников также являются еще более мощными драйверами модернизации в рамках коллаборации Бизнес-Университет в Центральной и Восточной Европе.

Ключевые слова
глобальные цепочки создания ценности – модернизация – Центральная и Восточная Европа – коллаборация Бизнес и Университет – инновационная политика

Spanish
Actualización de la cadena de valor global y colaboraciones entre empresas y academias: estudios de casos de innovadores exitosos

Agnó Paliokait, El-ebieta Jasinskáit y Marek Tiits

Resumen
El documento vincula la mejora en las cadenas de valor globales con el concepto de triple hélice centrándose en las colaboraciones entre empresas y academias que desempeñaron un papel en la capacidad de actualización de las empresas. Ambos son cruciales para los países de Europa Central y Oriental, que se enfrentan a la necesidad de reestructurar sus economías y escapar de la “trampa de ingresos medios”. El documento se hace la siguiente pregunta de investigación: ¿cómo pueden las políticas públicas fomentar la colaboración entre empresas y academias u otros tipos de actividades que contribuyan a la mejora de las empresas? Se analizan datos sobre cuatro estudios de caso diferentes en Lituania para responder a esta pregunta. Los resultados
indican que se necesita desarrollar capacidad tecnológica endógena a través de una variedad de tipos de colaboración entre empresas y universidades para atraer inversiones extranjeras directas de mayor valor y facilitar la mejora de la cadena de valor global intersectorial y funcional. Además, además de la investigación y el desarrollo, es probable que la educación y la formación de la fuerza de trabajo sean motores aún más poderosos para la colaboración empresarial y académica en Europa Central y Oriental.

**Palabras clave**

cadenas de valor globales – actualización – Europa Central y Oriental – colaboración empresa-academia – política de innovación

**Introduction**

The transition towards a knowledge-based economy is expected to bring higher value-added employment, greater productivity and, ultimately, lead to increased economic growth. However, turning know-how into growth requires innovation capacity, i.e. the ability to commercialise a flow of innovative technologies (Veugelers 2017). Although during the last decade, countries across the European Union (EU) have implemented a range of policies to improve their innovation capacity, large heterogeneity among countries persists. The countries of Central and Eastern Europe (CEE) are still struggling to converge with those in Western Europe (Veugelers 2017). Mostly, the CEE countries continue to rely on labour-intensive industries, making them susceptible to the “middle income trap” (European Bank for Reconstruction and Development 2017).

There is ample empirical evidence that firms, clusters and regions improve their innovation performance through their involvement in global value chains (GVC) (e.g. De Marchi et al. (2015) analyse 114 sources). However, merely joining the GVC does not guarantee upgrading, and an economy might remain stuck in low value activities. The so-called “high-road development” (Parrilli and Blažek 2018) may be pursued on the condition that firms and clusters focus on effective upgrading processes (Humphrey and Schmitz 2002), which are often made possible by several factors, including triple helix collaborations (Etzkowitz and Leydesdorff 2000). Such collaborations have been discussed as an indispensable mechanism of knowledge transfer that is capable to support countries in boosting innovation, especially by facilitating business-academia
collaborations (Ahuja 2000). In this article we would like to explore the link between GVC upgrading and the triple helix in CEE by focusing on business-academia (BA) collaborations that played a part in allowing firms to take the so-called “high-road” of GVC upgrading. This “high-road” upgrading refers to firms gaining competitive advantage over others by increasing the quality of their goods or services. Within this context, we perceive a firm’s upgrading within the GVC as a successful (or highly sought after) result that is conditioned by other factors, including government policy and firm-level factors, both of which further benefit from BA collaborations.

So far, only limited knowledge is available on the different GVC upgrading strategies and their conditioning factors in the CEE region. Lithuania may be considered a small open economy within CEE that specialises in labour intensive traditional industries. The country ranks 22nd on the European Innovation Scoreboard (European Commission 2019). Most of the R&D activities are funded and performed by the public sector, while business R&D expenditure remains well below the EU average (Visionary Analytics 2019). At the same time, there have been serious obstacles for public R&D commercialization and systemic collaboration (reflections of path-dependency): overdependence on fundamental science, unattractive research careers, lack of social capital and network failures, weak innovation diffusion system, and low motivation to learn. However, while the private sector, in its current specialisation, does not perceive innovation as a critical factor to long-term competitiveness (Paliokaitė and Gonzalez Verdesoto 2017), some successful innovators within this context have been identified.

The key purpose of this article is to look at different successful GVC upgrading strategies within innovative firms in relation to BA collaborations and, more particularly, investigate the role of multinational enterprises (MNEs) in influencing BA collaborations. In broad terms, the key research question is focused on the role of policy in facilitating knowledge-based growth – how can public policy encourage BA collaboration or other types of activities that contribute to firm upgrading in GVCs, and thereby foster innovation as well as escape the middle income trap? To answer this question, the article provides a comparative analysis of four case studies of successful innovative firms in Lithuania. We focus on the following questions:

1. How do different GVC upgrading strategies within firms, and especially MNEs, relate to BA collaborations?
2. How do MNEs influence BA collaborations?
3. What role may the government play in facilitating BA collaborations or otherwise supporting activities that lead firms to GVC upgrading?
Further discussion is presented as follows. Our literature review (see “GVC upgrading, MNEs and business-academia collaboration”) provides a synthesis of current knowledge on upgrading strategies and drivers and shows how multinational enterprises link to BA collaborations. The section on research methodology presents the criteria for selecting the case studies and methods for data collection and analysis. In the third section, we discuss the selected four case studies. We conclude the article with a short summary of our results, recommendations for policy, and future research topics (see the “Conclusions” section).

1  GVC Upgrading, MNEs and Business-Academia Collaboration

1.1  GVC Upgrading Strategies
Upgrading in GVCs is defined as a move from lower- to higher-value added activities. In literature on GVCs there is a well-established four-fold typology of upgrading options (Humphrey and Schmitz, 2002). 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. Niche or intersectoral upgrading means applying the competence acquired in a particular function to move into a new sector. Functional upgrading – arguably the most desirable type of upgrading – refers to acquiring new, superior functions in the chain. Manufacturing firm participation and upgrading in GVCs has often been understood within a framework of three clearly distinct functions that such firms undertake, namely 1) production/assembly activities; 2) pre-production activities such as design or R&D; 3) branding and marketing activities (Gereffi 1999). However, various combinations of upgrading have been documented (Blažek 2016), such as voluntary transfer of some high value-added functions by lead or higher-tier firms to their lower-tier suppliers, upgrading via mergers or acquisitions, or developing new markets by introducing new types of goods or services, all of which suggest that GVC upgrading is a complex and highly dynamic process. The “catch-up cycle” theory (Lee and Malerba 2017) acknowledges the possibility that latecomer firms and industries that learn from the GVC may take the leadership of sectors by creating their own value chains. Lee and Malerba (2017) especially emphasise the discontinuities of technological development (disruptive technologies), markets and institutions as opportunities for upgrading. The rationale being that more agile actors, who are not heavily invested into already existing models, may benefit hugely from disruptions. Individual entrepreneurship in this case is highly relevant because individuals, who choose to pursue new
opportunities rather than retain customary ways of doing business, may steer their firms towards innovation and growth. At the same time, public entrepreneurship within public sector organisations may prove important. It aims at innovative activities such as the development of new and existing services, technologies, administrative techniques, and new improved strategies, risk taking and productivity, which enables firms to embark on riskier ventures they might have avoided otherwise (Kearney et al. 2007).

**GVC upgrading may be driven by factors that could be summarised under three broad categories. First are the non-policy factors of GVC participation, which relate to market size, location, level of development and industrial structure. Second are the policy factors that affect firms’ upgrading capabilities, such as skilled labour supply and the business environment. Trade and other policies may be significant (OECD 2015), e.g. low import tariffs both at home and in export markets or inward FDI openness might facilitate GVC engagement, while other policies, such as intellectual property protection, or infrastructure development, might help to attract further high-value FDI. For example, MNEs’ offshoring strategy often takes advantage of natural resources or lower production costs, but over time some MNEs might activate a process of local incremental learning and move toward product improvement (McCann and Mudambi 2005). In other cases, MNE investments are driven by technology-seeking motives and the wish to benefit from new location in terms of innovation and new knowledge absorption (Kenney et al. 2009). Availability of a large talent pool, research infrastructures and strong local clusters is crucial for attracting such investment, hence the relevance of BA collaborations in this case should not be underestimated. Finally, a third category of driving factors are the firm-level factors such as employee skills, internal learning routines etc., all of which affect a firm’s internal capabilities. Literature has shown that in order to absorb and benefit from knowledge spillovers, firms must have a certain degree of absorptive capacity (Humphrey and Schmitz 2002; Giuliani et al. 2005). Opportunities offered by GVCs will be of little use unless firms have the ability to internalise this external knowledge through their R&D, upskilling and training strategies. When absorptive capacity increases, a firm’s position in the GVC could upgrade due to its improved ability to exploit knowledge. This third category of factors that may have a direct effect on a firm’s position in the GVC could also be directly supported by ongoing BA collaborations.**

### 1.2 Business-Academia Collaborations and Multinational Enterprises

The triple helix model promotes cooperation between business, university and government organizations by placing an emphasis on commercialization, and thus aiming at knowledge-based growth of the whole region (Etzkowitz
and Leydesdorff 2000). However, triple helix relations were said to be less visible and less significant within the CEE country context due to fragmented national R&D systems, inherited since the collapse of communism (Ranga and Etzkowitz 2010). In Lithuania, the attempt to reform the national R&D system, similarly to other CEE countries, has been mostly dependent on EU funding. In this particular case, the policy measures largely focused on strengthening the university research function via development of research infrastructure, and supporting BA collaborations in two major forms, namely through subsidising joint R&D activities and incentivising small-scale problem-solving by enabling companies to purchase research services from HEIs or research institutions (Visionary Analytics 2019). However, evidence from recent evaluations (Visionary Analytics 2019; MOSTA 2018) suggests that BA collaboration remains limited. Companies operating in Lithuania often lack the resources, the motivation or internal technical capacity to benefit from systematic collaboration, while most interactions remain based on personal contacts (MOSTA, 2018). At the same time, former research conducted in Hungarian firms has shown that most industries do not necessarily value such public endeavours, because academia is said to be a less important source of information for innovative firms than their own enterprise, customers, suppliers and/or other firms (Havas 2015). And while the issues described above could seem unique to specific CEE countries (Lithuania and Hungary), research conducted in the US has shown, likewise, that public research is far from the main source for starting new industrial R&D projects, with the exception of pharmaceutical and several other industries, e.g. aerospace or semiconductors (Cohen et al. 2002). Instead, the motivation to pursue technological advancements originates from the firm’s own R&D, its customers or the manufacturing process. Hence, it is unsurprising that firms may perceive BA collaboration to be a non-core activity, – this has been documented in numerous instances within Norwegian firms by Brekke et al. (2014), Nesse et al. (2014), and Rubach et al. (2014) (cf. Larsen et al. 2018). Within this context, GVC integration and upgrading seem beneficial insofar as they expose firms to more dynamic markets and increase the demand for innovation. Public research, on the other hand, plays a more significant role during the firms’ ongoing projects (Cohen et al. 2002). Furthermore, Paliokaitė (2019) and Havas (2015) observed that firms face different needs, possess distinctive capabilities and engage in different types of BA collaborations, but innovation policies (esp. in the CEE countries) tend to neglect this diversity, focusing mainly on strategic, long-term R&D (Havas 2015).

The typology of BA collaborations developed by Inzelt (2015) enables to identify a larger variety of BA collaborations and gain a better grasp on the
depth of these collaborations. BA collaboration types are classified according to their depth and function: 1) the least intense types of collaboration for information gathering or knowledge dissemination purposes takes place between isolated entities. These include ad hoc consultations and discussions, purchase of university research results or firm employee lectures in universities (or vice versa); 2) far distance and arm’s length cooperation is more intensive, with information gathering, knowledge dissemination and some types of R&D activities being its purpose. Collaboration types include employing faculty members at firms, training firm employees by professors, joint thesis supervisions, publications or IPRs between firm and university employees; 3) triple helix (horizontal) collaboration is the most intense form and is conducted for R&D purposes. These include joint R&D activities, regular acquisition of research, and access to firm/university equipment or investment in university research facilities. This type of collaboration may also be considered strategic, long-term R&D, according to the tentative BA collaboration taxonomy as proposed by Havas (2015). Each of these collaborations clearly responds to different firm needs, and while policy measures in Lithuania have mostly been encouraging the third collaboration type, given the originally weak linkages between businesses and academia in the context of post-socialist and post-communist economies, the limited success of these measures is hardly surprising (Ranga and Etzkowitz, 2010; Inzelt, 2015).

At the same time, policies towards BA links have become increasingly driven by encouraging universities to directly contribute to economic development through commercialization of their discoveries, e.g. through licensing of patents, creating science parks or establishment of business incubators and encouraging start-ups. This is largely in line with the reconceptualization of universities as important institutional actors within regional innovation systems (RIS), whereby governments seek to use them as instruments for knowledge-based growth (Mowery et al. 2005). However Janger (2015) argues that such narrow focus without ensuring that universities’ first two missions, namely research and teaching, work well, is an ineffective approach towards increasing the contribution of universities to innovative activity. In particular, the role of training graduates is not stressed enough, even if it remains one of the most significant university contributions (Caraça et al. 2009). Furthermore, these policies, while common in advanced market economies, need additional efforts to be effective in the CEE region, given the lack of entrepreneurial skills and effective tech-transfer capacities (Ranga and Etzkowitz 2010; Inzelt 2015; Visionary Analytics 2019).

There are several ways according to which territories can benefit from having MNEs undertaking an “anchoring role” in triple helix collaborations (De Marchi
et al. 2017). First, to complement and foster local resources with global ones, MNEs employ foreign technicians in R&D activities in order to facilitate the activation of collaborations with research institutions abroad, integrating and thus increasing the knowledge stock in the area. New inputs and innovations also arise from the continuous collaboration with international universities, research centres and international artists (leading architects and designers). Second, following a technology-seeking strategy, MNEs may acquire companies in related sectors to upgrade their products and boost parent company innovation capabilities. Third, MNEs are one of the territorial actors that can play the role of “anchor tenant” in a regional system of innovation; universities and public laboratories might also assume this role (Feldman and Desrochers 2003). Thus, the impact of an MNE acting as “anchor tenant” on the reproduction of the local resources system can be fostered by initiating partnerships between companies and technical institutes/universities in the region. Finally, MNEs can sustain the regeneration of the “industrial commons” by recombining specificities of geographically close industrial clusters, enabling them to create new products or market niches (inter-cluster innovation).

1.2.1 Research Approach and Methods
This article follows a comparative case study method (Jansen and Rodgers 2001), where a company that upgraded in a GVC is the object of analysis. The case study sample is summarised in Table 1. It focuses on four upgrading types, each involving a collaboration initiative by following an updated typology of production and innovation networks as suggested by Kattel and Varblane (2017) and typologies of upgrading within a GVC as suggested by Humphrey and Schmitz (2002). We selected two A-type companies as separate cases (Thermofisher Scientific Baltics and Global Business Service centres) because they showcase considerable differences between upgrading strategies and BA collaborations, enabling us to detect diverging patterns and networks.

To explore the dynamics of GVC upgrading and BA collaborations, we performed an in-depth analysis of case studies over a period of time. The company cases were selected from economic activity areas with substantial promise of innovation in the Lithuanian economy, all of which (ICT, health and biotechnologies, and energy technologies) had been chosen alongside four other strategic priorities of the Lithuanian Smart Specialisation Strategy (RIS3). Furthermore, well-established companies with a history of growth and GVC upgrading were selected for further study – different types of GVC upgrading were expected to reflect in the case studies. A total of 32 companies were considered for analysis. The final selection was seen as showcasing the most interesting and relatively clear-cut cases of GVC upgrading as opposed to other
Table 1: Case study structure

| Type of company                  | Upgrading strategy          | Case study / Sector                      | BA collaboration               |
|----------------------------------|-----------------------------|-----------------------------------------|--------------------------------|
| **A-type – foreign owned companies.** The parent company has given them an additional opportunity to build their own cooperation network of local businesses and to move from production towards development activities, involving local R&D workers or product developers. | A→B, Process and functional upgrading | GBS centres Thermofisher Scientific Baltics (molecular biology products) | Intelligent Process Automation Initiative Spin-out from / Strategic partnership with Vilnius University |
| **B-type – locally-owned companies** that have managed to build an international concern and the companies themselves have become leaders of international service provision and production networks. | Niche/inter-sectoral upgrading and diversification | Global BOD Group: BOD Lenses, Solitek and BOD Group (optical lenses, solar modules, compact discs) | Photovoltaics technology cluster; R&D collaboration (Horizon 2020); initiation of joint study and training programmes |
| **C-type – born-globals** – new ventures that act to satisfy a global market from day one. Often small technology firms – global startups – that from the beginning seek to become global and globalize rapidly without any preceding long term domestic or internationalization period. Often develop or work with disruptive innovations. | GVC integration (first step of upgrading) / Global market from day one | Devbridge Group (software development) | Sorcery Academies (KTU) |
companies considered. The case of GBS centres was chosen as it was perceived to be an interesting and somewhat unique case of GVC upgrading “in progress”. In other words, the initiative is still in its early stages, hence following its development offers insight into the process of GVC upgrading and its complexities rather than just the results. The GBS case also covers an important area for the Lithuanian economy. However, while the object of the first case study is an initiative to facilitate upgrading rather than a company, it is was included in this article as a valuable example of how the public sector may actively contribute to this process.

The information provided in the case studies stems from an extensive literature review and other publicly available information (company webpages, annual reports, previous case studies, podcasts, interviews, public databases, etc.). Certain company data (turnover, profit and the number of employees) was purchased from a private credit reporting and debt collection company Creditreform. Additional empirical data has been gathered through seven in-depth semi-structured interviews with the selected firms’ CEOs and upper level managers (5 interviews), and public actors (2 interviews) from the Lithuanian national investment agency during the spring and summer of 2019. The final case studies were validated by the company representatives to avoid any factual errors or misinterpretations. A short version of the questionnaire is provided in the Annex.

In the sections below we analyse each case study (except the first one, because it focuses on a group of firms in relation to a public sector initiative) by following a similar structure: the introduction of the company and its evolution; GVC upgrading strategy and its drivers; the impact it had on the key firm performance indicators; evolution of the knowledge networks within the triple helix (especially BA collaboration), and relevance of policy factors that played a role in upgrading and hence facilitated knowledge-based growth.

2 Successful Innovators: Four Case Studies

2.1 Global Business Service Centres
GBS centres play a substantial role within the Lithuanian economy. Roughly since 2010, there has been a growing interest from MNEs to relocate their regional back office operations to Vilnius. This has strengthened Lithuania’s prospects of becoming a regional hub for various services, including, but not limited to, financial and IT operations. A clear trend of steady growth in the number of GBS centres has been visible since 2007: in 2007 there were 16 GBS centres, in 2010 there were 23, in 2013 there were 36, and in 2016 there were
60 GBS centres across the country (Invest Lithuania 2018). A very large number of these centres were established as investments from neighbouring Nordic countries, i.e. Denmark, Sweden, Norway and Finland. However, investments from US-based centres have also become prominent during the last few years. As a result, US and the Nordic countries remain by far the largest investors in GBS centres in Lithuania. At the start of 2019, there were 80 investor companies with GBS centres in the country, employing approximately 18,000 people (Invest Lithuania, 2019). GBS centres provide various functions such as software development, data analytics, infrastructure management, cloud operations, business controlling, data management, audit, recruitment and a wide range of other operations for businesses around the world. A large majority of GBS centres cooperate with local higher education institutions (HEIs). Such collaboration is mainly driven by the need for talent and qualified employees, yet collaboration driven by innovative product or service development is also starting to emerge.

Typical collaboration initiatives include GBS centres delivering trainings and lectures, establishing joint training or study programmes, providing scholarships, and establishing internship placements, or thesis partnerships. Finding qualified professionals with the right set of skills needed for developing IT solutions in areas such as data science and AI is a key priority for GBS centres and businesses worldwide. GBS centres operating in Lithuania are no exception and therefore tend to invest into raising talent early on. Even though a majority of GBS centre employees (as many as 90%) have obtained tertiary education, professional experience and competence development is needed to ensure full capacity of delivering the most state-of-the-art solutions. The GBS centres provide attractive career opportunities to those, who are willing to learn and acquire new skills at the workplace. This approach has enabled the sector to grow and mature internally, while local HEIs provided the initial push towards relevant competence development. Over the last decade, some HEIs have been putting additional efforts to respond to market needs, especially focusing on the emerging IT sector but system-wide issues still remain.

2.1.1 The Intelligent Process Automation (IPA) Initiative

While investors initially had chosen Lithuania as an investment location due to global labour arbitrage, over the last few years, more high value-added functions were introduced to GBS centres, such as mechanical and electronic engineering, mobile app development, cyber security, audit, analytics and robotics. Invest Lithuania, a national agency for FDI and Business Development, after careful investigation in 2018, launched an initiative to support GBS centres in introducing intelligent process automation (IPA) solutions1 in 2019. The
key goal of the IPA Initiative is to support further upskilling of GBS centre employees and in this way, help the GBS centres transition towards more high value-added functions. The demand for IPA solutions within the GBS sector worldwide is rapidly growing. It enables upgrading the processes and making service provision significantly more effective. The implementation of IPA solutions does not require large investments in infrastructure, and the technology is particularly beneficial to companies that have lengthy process chains with repetitive operations. Robotic process automation (RPA) is said to be a first step in introducing the more advanced IPA technologies, which require almost no human supervision to carry out tasks, and will be the first step for some GBS centres. Other centres, however, already employ RPA solutions (34% of all GBS centres, Invest Lithuania 2019) and develop such solutions in-house, so the initiative is meant to support employee capacity building towards the more advanced IPA operations.

The initiative has three parts, each responding to a particular challenge faced by GBS centres (Figure 1).

At the moment, Invest Lithuania is mostly focused on providing support for mobilising and training local talent. The agency has agreed with an international

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**Figure 1**  The IPA initiative scheme

**Source:** Authors’ elaboration based on the interview with Invest Lithuania representatives
software provider UiPath to help local universities introduce relevant IPA course modules. UiPath will provide a complete training programme to university lecturers and software tools for students free of charge. The universities, on the other hand, are expected to commit to training a certain number of students in this field, while GBS centres would cover the initial costs of training. Invest Lithuania has arranged a public-private partnership scheme with local universities (Vilnius University and Vilnius Gediminas Technical University), as well as Code Academy, a private organisation that provides reskilling services to those who wish to start a career in IT. Code Academy is expected to begin the first IPA training modules (40 hours of theoretical and 20 hours of practical training) in early 2020. The modules should be made available for students enrolled both in IT related and management study fields. The course modules are also going to be open to GBS centre employees, who will attend modules as a means of upskilling. VGTU is expected to start a course together with UiPath in spring of 2020, while VU has established a partnership with another IPA software provider BluePrism. In the future, Invest Lithuania expects the initiative to continue without further state intervention. Furthermore, it also hopes to facilitate the establishment of the Artificial Intelligence Centre, a research organisation comprised of data scientists, engineers, machine learning experts etc. who could develop advanced solutions in the field and contribute to the overall progress of AI solutions.

Although the results remain to be seen, there are several success factors behind the launch of IPA initiative. First, the availability of public entrepreneurs (Werker et al. 2017) is the most crucial one. The IPA initiative was launched by the internal team responsible for GBS at Invest Lithuania together with participants of a one-year public service programme Create Lithuania that may be broadly defined as a public entrepreneurship initiative. Second, institutional support and a clear top-down strategy at Invest Lithuania, which aims at ensuring that Lithuania becomes a central hub in CEE for developing IPA solutions and remains an attractive investment location, was important. Finally, a strong bottom-up community of GBS centres, including Swedbank, Danske Bank, SEB, Telia, Western Union, Nasdaq, Outokumpu and others, is a relevant factor, because they are expected to move the IPA initiative further without public funding.

2.2 Thermo Fisher Scientific Baltics

2.2.1 Company Evolution

Thermo Fisher Scientific Baltics has roots stemming back as far as the late 1970s, when Lithuania was still part of the Soviet Union. Before becoming a private
enterprise, the company was a part of the Institute for Applied Enzymology that had been established in 1975 to study the purification of enzymes and develop tools for molecular biology. After Lithuania regained its independence in 1990, the Institute was renamed to the Institute of Applied Enzymology “Fermentas”. In 1994 “Fermentas” became a separate enterprise and was later privatised, while the Institute was renamed to the Institute of Biotechnology (from 2010 part of Vilnius University). The privatisation of Fermentas took place within the context of wider transformation in the Lithuanian economy, where shares of many state-owned entities were sold for investment vouchers that had been distributed amongst all citizens (Maldeikis, 1996). The employees of the Institute agreed to pool their investment vouchers together to buy its shares. This was meant to ensure that the Institute remained intact as a single entity in the hands of its employees, as opposed to selling shares for persons whose sole interest was to make direct profit from privatising, selling property and eventually liquidating the entity. The Institute had both R&D and manufacturing facilities, yet for the sake of efficiency and financial feasibility, it was decided to re-structure the Institute by separating them – the manufacturing base was transformed into several private enterprises (including Fermentas) while fundamental research activities resumed within the R&D facilities as part of the publicly funded Institute of Biotechnology. Fermentas successfully established a brand name for its products during the 1990s and begun joint venture businesses in Germany (1992), Canada (1996) and the United States (1996). Although the company was already producing highly advanced products, with significant investments in R&D and clients from over 50 countries, in 2010 the company, together with its international branches, was sold to a US MNE Thermo Fisher Scientific for $260 million (the largest M&A deal in Lithuania at the time). Since 2010, the company became known as Thermo Fisher Scientific Baltics. The acquisition opened vast new opportunities and propelled immense company growth. Within this context, ongoing collaborations with local HEIs played an important role in allowing the company to build competence that was necessary for sustaining such growth within the highly competitive biotech industry.

2.2.2 Upgrading Strategy and Its Drivers

Fermentas was a profitable and well-established company that was on the verge of expanding its product range, yet to remain a leader in the biotech industry within the region, it needed much larger investments and access to international know-how. It produced a range of products based on the use of DNA and enzymes, such as restriction endonucleases, DNA/RNA modifying enzymes, reagents, nucleotides, protein markers etc. The production was
always oriented towards international markets, and especially towards the US, because the market for biotech products was significantly larger than any market in Europe. To gain better access to this market, Fermentas moved its HQ to Canada, after establishing the consolidated company Fermentas International in 2002. According to the former CEO of Fermentas International the decision to sell the company “was not about the money, but rather about getting access to advanced technologies and bigger opportunities”. Fermentas International had reached its limits of creating innovative products and conducting frontier research, because expanding the product range required advanced competences in areas where the company had little experience. Furthermore, the period of late 2000s was marked by ongoing mergers between innovative biotech companies: Thermo Fisher Scientific itself was established in 2006 via a merge between Thermo Electron and Fisher Scientific. Fermentas International was under pressure to either consolidate with another large enterprise or risk to remain a relatively small company that would be outcompeted by large international corporations. The company initiated the process of finding a suitable bidder and sent out teasers to handpicked potential investors. After lengthy negotiations, a deal was agreed upon with Thermo Fisher Scientific, which offered an attractive price and guaranteed further investment in company development. Thermo Fisher Scientific saw Fermentas International as a safe investment, given that the company had already established production processes, a strong R&D department and steady profit.

2.2.3 Impact of Upgrading on Company Performance

Once sold, the company underwent massive growth. Between 2010 and 2019 the number of employees grew almost thrice while turnover increased almost ten times (cf. Figure 2). Manufacturing functions expanded the most, hence in 2013, the company was assigned to participate in a Fast-track Practical Process Improvement (PPI) programme to further improve its processes and accommodate such rapid enlargement. As a result, the company was awarded the prestigious Shingo Prize for operational excellence, the first company to achieve such an award in CEE.

The company site in Vilnius continues to specialise in producing reagents for molecular biology research, with products used to study gene structures, expressions and varieties and to create new diagnostic methods for hereditary or infectious diseases. After the acquisition, former Fermentas International gained access to intellectual property not only owned by Thermo Fisher Scientific, but also, after several M&A deals, that of its former competitors. This enabled the company to expand its research and manufacturing activities to include not only new but also more technologically sophisticated products.
The R&D centre expanded from approximately 80 to 140 employees. After the purchase, the company also had to rapidly create new products, hence the department of intellectual property expanded to employ more analysts to perform legal risk assessments and work with patent registrations.

2.2.4 BA Collaboration and Policy Factors

*Thermo Fisher Scientific Baltics* maintains very close ties with Vilnius University (the Institute of Biotechnology was incorporated into this university). Company employees teach courses at the University (the Life Sciences Centre), participate in setting the study curricula, conduct joint seminar sessions, and occasionally, collaborate with the University's researchers. However, the company generally collaborates with all major universities across Lithuania that provide studies in related areas, namely Vilnius University (VU), Vilnius Gediminas Technical University (VGTU), Kaunas Technology University (KTU) and Vytautas Magnus University (VDU). The company has made agreements and announces regular calls for undergraduate and graduate students to write theses on proposed subjects. Students with successful applications receive scholarships and are invited to conduct their research at the company's labs.
There are also several PhD students employed at the company to work on dissertations directly relevant to the company's activities, and company employees are invited to the dissertation commission. The company also maintains close ties with Vilniaus Kolegija/University of Applied Sciences and has established a joint study programme. The programme offers undergraduate studies in biotechnology with an apprenticeship at Thermo Fisher Scientific Baltics. After completing the programme, students may be invited to join the company as mid-level technicians and work in manufacturing. Establishing and maintaining these collaborations have been strategically important to the company, given its specific area of economic activity. The company has always been invested in educating potential future employees. For example, Thermo Fisher Scientific Baltics initiated a lecture cycle on validation processes at KTU together with partner companies Teva Sicor and LS Consult. The company also has an ongoing initiative for schools – the Mobile Bioclass (LT Mobilioji bioklasė), which is implemented together with Vilnius University. Company employees, together with students from Vilnius University, visit high schools with a mobile biochemistry lab that contains all the necessary equipment for basic molecular biology research (supplied by Thermo Fisher Scientific Baltics). During the visit, school pupils are taught how to use the equipment and conduct several experiments. It is free of charge and all costs are covered by the company.

The former Fermentas International received support from the European Regional Development Fund (ERDF) during the period of 2007–2013. This enabled the company to make investments in infrastructure and R&D projects that it otherwise would have taken longer to achieve. Thermo Fisher Scientific Baltics now invests in Vilnius site from its own resources. Most important, however, was the company strategy to build competence in order to sustain development that has been in place since the early 1990s and has proven essential for company growth. While the company also benefits from several perks such as the profit R&D tax incentive, or the newly established patent box,² company representatives believe such measures are nice-to-have but are not a must-have and stress the importance of more basic needs, such as a stable investment environment and available competences, accompanied by relevant infrastructure.

2.3 **BOD Group**

2.3.1 Company Evolution

BOD Group started their business in 1998, when it established the first compact disc manufacturing plant in the Baltic States. Over the last decade, the
company has transformed into a holding company with five spin-off companies across the region. The BOD Group companies employ approximately 190 people in Lithuania and 250 in all Baltic States. To this day, BOD Group remains one of the largest manufacturers of industrially pre-recorded CDs, DVDs and Blu-ray discs in the region. The plants in Vilnius and Tallinn together produce more than 70 million discs per year, which are exported to 49 countries worldwide. The company established its first spin-off company Soli Tek in 2009. Soli Tek was established as a small photovoltaic cell research and manufacturing centre and within the last decade, it expanded to a leading solar cell and panel developer and manufacturer that exports around 90% of its production to markets across the EU. Soli Tek produces photovoltaic polycrystalline cells that are arranged into solar panels. It employs approximately 60 people. In 2015, Bod Group entered the optical lens industry, after installing an Rx lens (prescription eyeglass lenses) manufacturing plant in Guopstos village (cf. Figure 3). At first, the BOD Lenses spin-off employed up to ten people and the plant operated for 8 hrs/day. However, it has successfully expanded to employ more than 80 people in 2019, with operations at the manufacturing plant ongoing 24hrs/day, 5 days/week. It exports to 16 countries, with EU being the main market.

2.3.2 Upgrading Strategy and Its Drivers
The main motivation for the transition within the BOD Group came from the need to explore other economic activities. After a decade of producing compact discs, the rise of internet-based distribution and an increasing availability of other data storage devices obliged the company to look for diversification opportunities. The economic crisis of 2008–2009 strengthened the otherwise already existent drivers for diversification. The two niches that were chosen as diversification options were closely related to the original CD manufacturing technology. Coatings and thin-film technologies, which were used in disc manufacturing, are also applicable to optical lens and solar cell manufacturing. While the manufacturing process for solar cells, optical lenses and compact discs for some stages is almost identical, other aspects differ significantly, hence employees required to gain new knowledge and skills. The motivation to diversify was strengthened by at least two additional drivers (Gaušas and Paliokaitė 2012):

- **Support from foreign and local partners.** Company’s long-term partner in Germany, Singulus Technologies AG, also a manufacturing company, shifted its business activities to solar technologies in 2007 and invited BOD Group to join the growing sector.

- **Public funding opportunities.** The decommissioning of the Ignalina Nuclear Power Plant made the development of alternative energy sources highly
relevant. Renewable energy was selected as a priority sector in the Lithuanian Innovation Strategy for 2010–2020 and subsequently, in 2012 it was included in the Smart Specialisation Strategy under the Energy and Sustainable Environment priority; throughout the period of 2014–2020 as much as 12 million euros were allocated for various activities under this priority.

Soli Tek entered the solar cell industry at the time when it was one of the fastest growing technologies and the clean energy market was expected to boom. However, the silicon shortage between 2005 and 2008 lead to an overproduction of the material in 2010–2013, which the manufacturing industry could not absorb. This resulted in an excess capacity of solar cell manufacturing and subsequently, to significantly reduced solar panel prices. Given the circumstances, many solar cell manufacturers could no longer remain competitive and went bankrupt. Soli Tek managed to remain in the industry, and although its plans for growth were affected, the situation provided opportunities to attract clients who had previously worked with other manufacturers. Soli Tek remains most successful in the Nordic countries (Sweden, Norway, Finland, Denmark), because these markets demonstrate a demand for advanced glass panels and are in close geographical proximity. However, the company’s turnover was negatively affected in 2018, when the EU ended anti-dumping duties on Chinese solar imports (Figure 3).

BOD Lenses was oriented towards export right from the start, when it purchased the Modulo line, a fully digitized and automated manufacturing equipment that enables to produce 4000 individualised progressive lenses per day. The optical lens industry is highly sophisticated and markets in Western Europe are mature – manufacturers such as Essilor, Hoya or Zeiss are well-established, so it took more than 6 months to find clients. BOD Lenses has now successfully entered the largest markets in the EU (UK, France, Italy, Spain, Poland, Cyprus/Greece) as well as expanded to several non-EU countries (Tunisia, Belarus). However, further expansion to markets in Eastern Europe or Asia is difficult due to a low demand in customised products (Rx lenses) that need to be prescribed by local ophthalmologists or optometrists.

2.3.3 Impact of Upgrading on Company Performance
Both Soli Tek and BOD Lenses saw a growth in their turnover and employee numbers, and as a result, the overall turnover and employee numbers for the whole BOD Group increased (cf. Figure 3). However, since 2017 profits have somewhat decreased because the manufacturing equipment for solar panels wore out and had to be updated. The expansion was accompanied by a steady process of upskilling. In both cases of Soli Tek and BOD Lenses, BOD Group invested in employee training and visits abroad. The high-skilled and the medium-skilled
Soli Tek employees received training in two stages. High-skilled employees, who shortly became process engineers, spent time training in Germany at the Fraunhofer Institute for Solar Energy Systems where they gained knowledge on the photovoltaic panels and systems. After installing the manufacturing equipment, they also received consultations from experienced professionals on how to operate it, increase effectiveness, productivity and ensure manufacturing...
quality. The medium-skilled personnel, mostly manufacturing operators, received training at the German company that produced the manufacturing equipment, where they were introduced to the manufacturing process and the various aspects of operating the equipment. The second stage of training took place during the launch of the manufacturing plant. Starting **BOD Lenses**, the manufacture of optical eyeglass lenses, was a challenge for the same reasons as **Soli Tek** – there were no qualified professionals in this field in Lithuania at the time. The team had to rely on professionals who were familiar with but had no experience in ophthalmic technology manufacturing. Except for one employee who previously had worked for the **ZEISS** enterprise, a leading manufacturer of eyeglass lenses and ophthalmic instruments, other employees had previously worked as opticians, lens cutters, frame fitters, or conducted similar activities in this field. Some employees came from the field of thin-film coating technologies. High-skilled employees spent time training in South Korea, Germany and France, and later received further instruction from the lens manufacturing plant provider Schneider GmbH & Co. KG.

2.3.4 **BA Collaboration and Policy Factors**

Maintaining close ties with partner companies and **HEIs** is necessary, if **SMEs** wish to retain their competitive advantage within the international market. **BOD Group** companies are therefore intensely involved in knowledge networks on both national and international levels.

**Soli Tek** is a member of the **Photovoltaics Technology Cluster (FETEK)** – a group that unites 7 research centres and 24 companies that are active within the sector. The cluster, established in 2008 via the **ERDF** measures targeted at formation of clusters, offers training opportunities, provides information on relevant international events and renders R&D services through its open access infrastructure. **Soli Tek** also maintains relatively close ties with local **HEIs**. In 2011, together with several other companies, **Soli Tek** co-created a two-year **PV** energy engineering master’s programme at **VGTU** (Gaušas and Paliokaitė 2012), but while the programme is still running, the company is not much involved in its further development. The company had an agreement with **KTU** and **VGTU** to fund one year of training in **PV** technologies in Germany for several of the best students from the universities' master's programmes between 2011 and 2013 on the condition that they would return and work at the company (Gaušas and Paliokaitė 2012). Even though such agreements were beneficial at the start, collaboration between universities and the company has evolved. Now the company continues to collaborate with **VGTU** and **KTU** by showing production facilities and welcoming students to work on their bachelor or
master theses’ in the company. However, there are no local HEIs that work in directly relevant areas and this prevents collaborations to advance. Only quite recently the competences in these universities have increased to the point where Soli Tek plans to enter a strategic partnership and develop joint technologies. Furthermore, lack of specialised infrastructure prevents local HEIs from developing and testing technology on a larger scale that could later be replicated in commercial production unless accompanied by significant albeit risky business investments. Soli Tek develops products in cooperation with HEIs located in Western Europe through the Horizon 2020 programme. Soli Tek participates in Horizon 2020 projects (five since 2015) in partnership with many European institutes and advanced businesses in the field, which helps to continuously develop technical skills and upgrade their products.

**BOD Lenses** collaborates with the Center for Physical Sciences and Technology (FTMC) in the field of thin-film coating technologies, because the centre has developed advanced competences in this field. The company also has several business partners that assist with developing design and technology solutions, but is not involved in projects with local HEIs as similar to the case of Soli Tek, HEIs lack relevant competences and the right infrastructure. **BOD Lenses** would benefit from developing deeper expertise.

Receiving ERDF support was a crucial step that enabled BOD Group to diversify its activities, but even more important was the national commitment and strategy to pay more focus to renewable energy sources. Likewise, for BOD Lenses ERDF support was also a major factor that enabled the company to start this line of business. The manufacturing headquarters are located outside of Vilnius because the ERDF support was specifically targeted at regional development projects.

### 2.4 Devbridge Group

**2.4.1 Company Evolution**

The US-based software development company *Devbridge Group* was found in 2008 by five expats from Lithuania, who were living in the US at the time. The company began as an IT consultancy business, with headquarters in Chicago. In 2011, the company expanded to open its first software engineering branch in Kaunas, Lithuania. Currently, *Devbridge Group* designs and develops custom software applications across five office branches worldwide and employs more than 400 people. According to the 2018 *Inc. 5000* list of fastest growing companies in the US, *Devbridge* was worth $28.4 million in revenue, while its three-year growth rate was 286%.
2.4.2 Upgrading Strategy and its Drivers

*Devbridge Group* targets the US market or US company subsidiaries located in Europe. Since its establishment, the company has focused on the US market, because it was the original company location and the founders were familiar with US market specifics. Initially the company offered internet website development services, but as the company grew, it acquired the capacity to provide more complex and larger scale software solutions. Several founders decided to return to Europe. Kaunas was chosen as an investment location because it was the hometown to company founders, and had a university which offered studies in IT disciplines (software systems, informatics, information systems and informatics engineering) directly relevant to the company. Even though the EU market, including Lithuania, faces shortages of IT specialists, the company founders believe it is easier to recruit the right employees in Lithuania than in the US, given the size of the market and the competition between other similar firms. Demand for specific IT solutions within the US market was and remains the main driving factor behind company growth.
The Chicago office remains the company HQ, where all major decisions on business development, such as product design, sales and marketing strategies, are made. Likewise, offices in Toronto and London are responsible for customer research, product design and project management. The Kaunas and Vilnius offices work on technical aspects of product development and its implementation. It was a strategic decision to keep product development functions in the overseas offices because in-house design teams must remain in geographic proximity to their customers.

2.4.3 Impact of GVC Integration on Company Performance

Devbridge upgraded its internal processes to accommodate company growth. The work process had to be standardised to facilitate product development and timely delivery of results, so the company introduced the Scrum process framework. As the company grew, squad units were introduced, while each company office was appointed with a regional manager.

The company’s internal culture plays a strong role in attracting talent and further upskilling. 80% of the company’s staff are experienced professionals. This policy enables Devbridge to maintain a competitive advantage in terms of providing innovative services rather than relying on cheap workforce. Devbridge only hires junior staff through its IT academies (see below) by selecting the best participants. Open vacancies are only announced for regular and senior ICT specialists or management positions. The company also dedicates one day per month for self-learning activities. The company does not have an in-house R&D department, but self-initiated internal training activities are regarded as R&D activities insofar as they contribute to trying out and experimenting with novel practices – project teams may lead trainings, knowledge-sharing sessions or organise internal events. Junior or less experienced regular employees participate in work shadowing or team discussions as means of improving their soft skills.

2.4.4 BA Collaboration: “Sorcery Academies”

Both Vilnius and Kaunas offices are currently facing shortages of software engineers and test engineers to work with .NET, JAVA and Full Stack JavaScript technology. Similarly to GBS centres (see above), the company has ongoing collaborations with KTU. Throughout the year, Devbridge runs the annual “Sorcery” Academies for those who are willing to improve their skills and enter the IT industry with help from experienced professionals. There are three academies, namely “Sorcery for Developers”, “Sorcery for Testers” and
“Sorcery for Front-End”, each oriented towards teaching students a specific set of skills. Academies are organised twice per year (spring and autumn). They are free of charge, yet students must pass an entry test. KTU assists Devbridge in holding this test and also promotes the academy. Regular and senior Devbridge employees undertake mentor and trainer roles in the academy. Devbridge collaborates with KTU by giving lectures and participating in thesis’ defence committees.

The company also runs the “Sorcery for Kids” academy. This programme seeks to make IT literacy available to as many children as possible in Lithuania. It offers courses to children between 7 and 12 years of age in programming free of charge. Sessions are held on Saturdays throughout the year, with Devbridge employees participating to give classes on a voluntary basis. The initiative also received support from the Kazickas Family Foundation, Inc., a US-based philanthropy organisation that supports education initiatives in Lithuania. Currently, more than 500 children attend programming sessions in across seven locations. The education programmes are expected to increase the number of students choosing to study fields related to IT by ten times. At the same time, Devbridge would like to see the Lithuanian labour market expand by an additional 100,000 IT professionals by 2023.

Devbridge may be roughly considered a born-global start-up, because the company began to operate from several locations almost right from the start of its establishment and provides IT services, which may be regarded as disruptive. While location plays a strong part in having access to global clients operating from the US, the service itself may be provided from any place with sufficient infrastructure and access to talent pool. In this case, the return of the Lithuanian diaspora was the defining link between the global market and the local resources. The success of such companies largely depend upon their capacity to access and enter the market, yet the role of HEIs should not be underestimated – world-class education is a must, if investments of innovative companies wish to be attracted. Education quality and relevance for company needs was emphasised as one of the most important aspects that sustains such company growth.

3 Discussion

Research results mostly confirm previous findings from literature that building endogenous technological capacity is needed to attract higher-value FDI and facilitate functional and intersectoral upgrading. Building such capacity
is strongly reliant on BA collaborations that may differ in their functions and depth as suggested by Inzelt (2015). Table 2 below presents a comparative framework of upgrading trajectories, BA collaborations and relevant policies. It is clear that while most BA collaborations may be classified as far distance, or arm's length, with information gathering and knowledge dissemination being their main purposes, closer cooperation is expected to emerge as both business and academia entities mature. The companies’ capacity for innovation is strengthened and sustained by these collaborations but does not fully depend on them, because the motivation to upgrade in the GVC remains fully external. Such depth of collaboration may also be partly explained by the still ongoing transformation of Lithuanian universities, as suggested by Ranga and Etzkowitz (2010), whereby their missions are expanding, but both research and entrepreneurship remain still relatively weak. Both cases of Thermo Fisher Scientific Baltics and BOD Group indicate that Lithuanian university capacity to cooperate remains rather limited. The historically close ties between Thermo Fisher Scientific Baltics and Vilnius University did not result in substantiably different depth of collaboration than in other investigated cases, while the BOD Group was and still is facing with a mismatch between university researchers’ competence and the firms’ own needs. The latter can also be said for a number of other companies within the Lithuanian economy, and the mismatch between the specialisation of public research institutions and company needs remains prevalent (Visionary Analytics, 2019). Hence, the strongest driver for BA collaboration concerns human capital, i.e. educating and training potential and current employees. Study quality is an issue of utmost importance for both GVC integration and upgrading. First, all interviewed companies stressed that further incentives needed to strengthen education (university and college or vocational) relevance for market needs. Second, access to science and engineering talent and qualified labour force in general was among the main motivations to invest (cases 1, 2 and 4). This implies that the country should actively foster the quality of its universities, e.g. through competitive funding and attractive career and organizational structures in open academic labour markets (cf. Janger et al. 2013).

FDI-based GVC integration is possibly the most effective route for visible performance results in short-to-medium term because it provides quick access to both the market and knowledge required for upgrading. In this case, however, already established BA collaboration patterns that include both arm’s length and the more intense deeper strategic collaboration seem an essential prerequisite. The success story of former Fermentas (currently Thermo Fisher Scientific Baltics) shows that companies with string local networks and
strong absorptive capacity are more likely to ensure knowledge transfer after GVC integration. The stronger the network, the greater the likelihood that a firm will hold a competitive position in a GVC, and that the MNE will act as an “anchor tenant” within the whole RIS (De Marchi et al. 2017). Building local value chains and internationalisation of endogenous SMEs (or building local MNEs), on the other hand, is a risky and painful road that requires large investments, without guaranteed success (BOD Group example). BA collaboration in this case shows a larger variety because local HEIs might lack deep competence is relevant areas, and more intense collaboration forms cannot emerge for the time being. The company in this case undertakes the knowledge dissemination function by supervising university graduate theses rather than vice versa. Within this context, encouraging FDI-based growth by targeting specialised and higher-value niches in GVCs suited to already existing production and technological capabilities that seem promising is very important. The Devbridge Group case study shows promise in exploiting the diaspora for attracting such higher-value FDI, but BA collaborations in that case risk being limited to fairly isolated or far distance linkages.

The selected case studies are somewhat revealing when it comes to the government’s role in developing triple helix relations. Mostly the government acts as a facilitator of collaborative relationships or seeks to strengthen the actors’ R&D capacity by providing financial support for innovative activities, infrastructure or other needs. It is clear that both BOD Group and Thermo Fisher Scientific Baltics benefited from long-term public investment in building R&D capacities that were in line with the country’s long-term priorities. Public support encouraged the successful innovators to take more risks when exploiting technological development opportunities. This is in line with the idea of smart specialisation strategies and “intelligent piggybacking” (Tiits and Kalvet 2013) i.e. focusing on restructuring and upgrading existing technological and production capabilities with greatest potential for future growth. The case study of the IPA initiative is a great example of how countries may be proactive in building targeted higher-value niches in GVCs. It shows that public entrepreneurs, acting in an enabling way, are crucial to start such triple helix collaboration initiatives with MNEs.
Table 2: Comparative framework of upgrading trajectories, BA collaborations and relevant policies

| Case 1: GBS centres | Case 2: Thermo Fisher Scientific Baltics | Case 3: Global Bod Group | Case 4: Devbridge Group |
|---------------------|----------------------------------------|--------------------------|------------------------|
| Global lead firm    | Foreign                                | Home-grown               | Foreign (LT expats)    |
| Upgrading trajectories | FDI-based growth: A→B, Functional upgrading | Building own value chains → Diversification Intersectoral upgrading (from CDS production to solar modules and optical lenses) | Born global → FDI-based growth: Process upgrading |
| Upgrading drivers  | Technological development and efficiency seeking (growing labour costs) Availability of skilled labour force | Markets and growth-seeking: competences, knowledge and technology-seeking, taking advantage of M&A as a form of open innovation trends in biotech sector. | Disruptive technologies, diaspora ties (established by five expats from Lithuania), availability of highly skilled workforce at relatively lower cost (compared to US) and relevant study programmes. Proximity to US markets remains main driver for growth and a bottleneck for functional upgrading of Lithuanian offices. |
| Case 1: GBS centres | Case 2: Thermo Fisher Scientific Baltics | Case 3: Global BOD Group | Case 4: Devbridge Group |
|---------------------|----------------------------------------|-------------------------|-----------------------|
| **Support by local institutions** | Institutional support (Invest Lithuania). Funding assumed at later stages for national AI competence centre, and for process upgrading from ‘Smart FDI’ ERDF package. | Investments in R&D infrastructure. Smart specialization strategy (RIS-3) | Investments in R&D and manufacturing infrastructure. Cluster policies. Smart specialization strategy (RIS-3) |
| **Impact of upgrading** | Remains to be seen | High: turnover scale increased tenfold, No. of employees tripled (mainly manufacturing), R&D department increased by 50%. Became a global Competence centre. Access to advanced products and subsequent upskilling. Knowledge spillover: impact on new biotech startups. | Overall turnover and employees No in the new entities increased, high impact on product and process upgrading, and subsequent reskilling. Risky investment, as market fluctuate (drop in solar energy prices forced other producers to bankrupt). | Overall turnover and employees No increased (almost 300% growth), high impact on process upgrading, and employee upskilling, which resulted in sophisticated internal training system. |
Knowledge networks – motivation and success factors

| Case 1: GBS centres | Case 2: Thermo Fisher Scientific Baltics | Case 3: Global BOD Group | Case 4: Devbridge Group |
|---------------------|------------------------------------------|--------------------------|-------------------------|
|                      | Strategic collaboration with former Biotechnology Institute at Vilnius University (and other universities). | PV technology cluster; R&D collaboration (Horizon 2020); initiation of joint study and training programmes, and cooperation with foreign science and education institutions (South Korea, Germany and France) on employee upskilling. | Sourcing academy (KTU and other actors) |
| Motivation: upskilling, shortages in talent, need for skilled employees, productivity-seeking; taking advantage of technological disruptions; aiming that Lithuania remains an attractive investment location. | Motivation: shortages in talent and need for qualified employees. | Success factors: strong historically developed ties (used to be the same entity, employees teach at university, and vice versa). | Motivation: shortages in talent and need for qualified employees |
| Success factors: public entrepreneurs with mandate to launch innovations, institutional and funding support. | | | No need for R&D collaboration. |
| | Strategic collaboration with former Biotechnology Institute at Vilnius University (and other universities). | PV technology cluster; R&D collaboration (Horizon 2020); initiation of joint study and training programmes, and cooperation with foreign science and education institutions (South Korea, Germany and France) on employee upskilling. | Sourcing academy (KTU and other actors) |
| Motivation: upskilling, shortages in talent, need for skilled employees, productivity-seeking; taking advantage of technological disruptions; aiming that Lithuania remains an attractive investment location. | Motivation: shortages in talent and need for qualified employees. | Success factors: strong historically developed ties (used to be the same entity, employees teach at university, and vice versa). | Motivation: shortages in talent and need for qualified employees |
| Success factors: public entrepreneurs with mandate to launch innovations, institutional and funding support. | | | No need for R&D collaboration. |
4 Conclusion

This article aims to contribute to a broader research question, namely what role can public policy play in facilitating knowledge-based growth by encouraging BA collaborations or other types of activities that contribute to firm upgrading in GVCs? By reviewing the literature on GVC upgrading and triple helix collaboration, and investigating case studies of successful innovators in Lithuania we proposed a tentative framework of different GVC upgrading trajectories (from FDI-based growth to born-globals) in relation to BA collaborations and relevant policies. It is intended to highlight the diversity of strategies and BA collaborations, offering potential insights for policy-makers interested to support upgrading through tailored and selective policies (rather than a one-size-fits-all approach), following Havas (2015) and Paliokaitė (2019).

Our findings suggest that absorptive capacity may be regarded as a bridging concept between GVC upgrading and knowledge-based growth. First, the case studies of successful innovators show that building endogenous technological capability, which is largely related to and depends upon BA collaborations, is needed in order to attract higher-value FDI and facilitate GVC upgrading. Secondly, while the more mature types of collaboration within the triple helix, such as conducting joint R&D, are expected to emerge, current forms
of arm’s length cooperation are more prevalent, possibly due to a particular institutional set-up within CEE. We believe that this discussion and the proposed tentative framework could apply to other CEE countries, and bring valuable insight. In accordance to our results, the following implications for policy should be noted:

– Human capital is the most critical asset that is necessary for triggering GVC upgrading and higher productivity. Given the key role of RIS’s in the modern globalized economy, efforts targeting individual companies could be combined with cross-cutting policies and systemic measures in the field of education and labor-force training.

– Policies able to support and promote the co-evolution of location-based advantages and GVCS are strongly needed in CEE. Industrial policies should include innovation, GVCS and FDI policies. This requires a holistic approach to mutually reinforce and create synergies. Such policies should identify potential development paths that recognize and enable transformations towards industry specializations, facilitate internationalization, and strengthen external connections, including across different knowledge networks and PROs worldwide, targeting specialized high-value niches in the GVCS and sustaining local firms’ insertion in GVCS.

While a case study approach has advantages, there are inherent limitations on generalizability. The four exemplars still represent a small subset of the various types of upgrading trajectories and triple helix collaborations currently underway within each CEE country. In line with the limitations of our results, we suggest that promising roads of further research are at least twofold. First of all, it would be fruitful to carry out more detailed research into different upgrading trajectories including a reasonably larger number of cases, including traditional industries, in various development stages and various contexts. Second, to get a fuller picture, additional comparative research would be needed to reveal in more systematic fashion the circumstances under which different collaborations develop and their impact on a country’s ability to upgrade.

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**Notes**

1. Intelligent Process Automation (IPA) refers to the application of Artificial Intelligence and related new technologies, including Compute Vision, Cognitive automation and Machine Learning to Robotic Process Automation (RPA). RPA is the technology that allows to configure computer software, or a “robot” to emulate and integrate the actions of a human interacting within digital systems to execute a business process. IPA robots utilize the user interface to capture data and manipulate applications just like humans do. They interpret, trigger responses and communicate with other systems to perform a variety of repetitive tasks. Source: Based on UiPath definition. Available at: https://www.uipath.com/rpa/intelligent-process-automation; and also see: https://www.uipath.com/rpa/robotic-process-automation.

2. See more at: https://data.consilium.europa.eu/doc/document/ST-9652-2019-ADD-3/en/pdf.

3. **Soli Tek** is a brand name, while the business itself operates as two separate companies for accounting reasons. Soli Tek cells is the company manufacturing and sales department, while Soli Tek R&D conducts R&D activities in photovoltaic solar cells. In this case study, the brand name **Soli Tek** will be used to discuss the business entity as a whole, given that both separate companies function as company departments.

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Annex. Questionnaires

1. Products and markets
   - Which are the company's most important products and their target markets?
   - How has the company's product profile changed within the last 5 years?
   - Has the market demand changed within the last 5 years, why?
2. Type and drivers of GVC integration and/or upgrading

- How did the company join the GVC – by M&A, exporting local products, or other?
- What were the main drivers for integration: location (e.g. geographical proximity, market size, availability of skilled specialists), policy (e.g. attractive business environment, high quality education), internal (e.g. skills and capabilities already acquired by the firm, previous collaboration experience) or other (e.g. diaspora) factors?
- After joining the GVC, did the company have a major change in process, product, functional or intersectoral upgrading factors?
- What were the main drivers and motivations for company upgrading?

3. Impact of GVC integration and/or upgrading

- Is the industry/sector, where the company is active, highly dynamic, why?
- How did the company perform within the last 5 years? Has it achieved one of the following: improvement of products, launch of new products, strengthening of position on the market, adoption of new marketing methods, other?
- How many employees are involved in product development or R&D? Has the number increased?
- What was the impact of GVC upgrading on the skills employees use at work and/or employee qualification structure?
- How do you encourage continued organisational learning and opportunity to improve skills and capabilities? How easy is it to find new employees, for which positions is it harder?

4. Collaborations

- Do you cooperate with local HEIs? What are the motivations and benefits of cooperation? How has this cooperation changed over time?

5. State’s role in facilitating upgrading

- Did your company use any of the existing State support measures (financial of nonfinancial) available for innovative companies? What are your impressions, benefits, drawbacks?
- Which State policy measures (funding, tax incentives, education policies etc.) are most relevant for further upgrading and development of your company?
1. The IPA initiative: basic information.

– What were the reasons for launching the IPA initiative? Which challenges is it a response to?
– How does the initiative work, i.e. how is it meant to be implemented and what are the expected results?
– Who participates in the initiative, which HEIs and which companies? Why these particular ones?

2. GVC upgrading conditions for GBS

– Which types of specialists do you think will be the most sought after in GBS centres in the near future? How does the IPA initiative address this?
– Which additional measures are needed for GBS centres to upgrade? Which role may or should the state play?

3. Collaborations

– Do the GBS centres generally collaborate with HEIs? What are the reasons for their collaboration?
– Can you give us a couple of good examples of GBS centre and HEI collaborations that have taken place over the last few years?
– Are there any initiatives for attracting and fostering talent in GBS centres? Could you tell us about them, i.e. which GBS centres are participating and why?
– What is currently lacking for more extensive GBS centre and HEI collaboration?