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PRIMER ON THE CLUSTER IMPACT ON INTERNATIONALISATION IN THE FORM OF FDI IN THE TIME OF INDUSTRY 4.0

Abstract. The novelty of Industry 4.0 (I4.0) as a research topic means that the literature covering the interrelations between digital business transformation and categories such as internationalisation, foreign direct investment (FDI), or clusters is scant. This paper shows that clusters may contribute to the advancement of I4.0 while at the same time they stimulate the internationalisation of indigenous firms and the inflow of foreign investors. Based on conceptual deliberations it develops a research agenda for exploring how clusters might affect OFDI and IFDI by facilitating the I4.0. It can advance our understanding on the spatial aspects of the ongoing business digital transformation.
Key words: cluster, Industry 4.0, internationalisation, FDI.

1. INTRODUCTION

The recent intersection between international business (IB) and economic geography (EG) or Strategic Management (SM) is still an emerging and rather inconclusive debate (Belussi and Hervas-Oliver, 2016). The novelty of Industry 4.0 (I4.0) as a research topic for international business and economics' scholars means that the literature covering the interrelations between this digital transformation and categories such as internationalisation, foreign investments, or clusters is scant. This paper aims at presenting considerations on cluster's impact on internationalisation, in particular on foreign investment, in the context of the I4.0. First, it presents briefly the main premises of the fourth industrial revolution which is supposed to affect the international business relations, although in a yet unknown way. Next, it shows that clusters may contribute to the advancement of Industry 4.0 (I4.0) while at the same time determining the competitiveness of the region. Thanks to

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the offered scale economies, externalities and other gains, a cluster may not only stimulate the internationalisation and expansion of domestic firms into new markets but also attract foreign investors. This is a result of the shaping of ownership (firm specific) and localisation (location specific) advantages (Dunning, 1980). By compiling these conceptual deliberations, this paper may contribute to the current discussion as it touches upon the so far neglected problem of the differentiation of clusters' impact on both outflowing foreign direct investment (OFDI) and incoming foreign direct investment (IFDI) in the era of digital transformation. It outlines the likely impact of identified channels on ownership and localisation advantages and thus on the capabilities of local firms to outward-looking internalisation and on foreign investors' interests in specific locations.

This paper may add to our knowledge on the role of space in the digital age and contribute to the understanding of the development of the competitive advantages of places and firms in the I4.0 era. Thus, it can also be seen as echoing the issues of "zooming-in and zooming-out", i.e. the multi scale aspects of IB as raised by Mudambi *et al.* (2018). To put the discussion in a broader perspective (Fig. 1), it should be stressed that the analysis zooms in on the indirect role played by clusters in foreign inward- or outward-looking expansion via its impact on Industry 4.0 (thick grey arrow). To the best of the authors' knowledge the available studies only began discussing the impact of I4.0 on broadly understood foreign expansion (Alcácer *et al.*, 2016; Strange and Zucchella, 2016; UNCTAD WIR, 2017; Hannibal and Knight 2018; Laplume *et al.*, 2016) and acknowledge that there are more questions than answers (Chiarvesio and Romanello, 2018). The influence of the fourth industrial revolution on global production networks has been also only recently analysed by researchers including the prestigious EU funded H2020 project MAKERS[1] which covers the general aspects of global value chains (GVC) and industrial districts ID (including clusters) or papers devoted exclusively to mutual relations between I4.0 and clusters (Götz and Jankowska 2017). Against this background, the scholarly work linking clusters with internationalisation – the most advanced form of that, i.e. foreign direct investment (FDI) – is relatively well established (Li and Bathelt, 2018; Jankowska, *et al.*, 2017; Jankowska and Götz, 2017; Pavelková, *et al.*, 2016; Ffowcs-Williams, 2012; Belussi, 2018).

This paper might be classified as a conceptual one – as it seeks to be discursive and cover discussions and comparative studies of other people's work and thinking. As its content is dependent on the author's opinion and interpretation, it might be also categorised as a viewpoint.

By drawing on the critical narrative literature review (Gancarczyk and Bohatkiewicz, 2018) the aim of this paper is to unpack the interdependency between clusters, internationalisation and digital transformation; in particular to recapitalise what is already known in terms of these concepts' mutual relations – i.e. the cluster impact

[1] See more: http://www.makers-rise.org/about/

on internationalisation via fostering I4.0 and to identify the research avenues for further studies in this respect. The considerations presented in this paper may help integrate current research in regional studies with that in international business by incorporating the concept of the fourth industrial revolution.

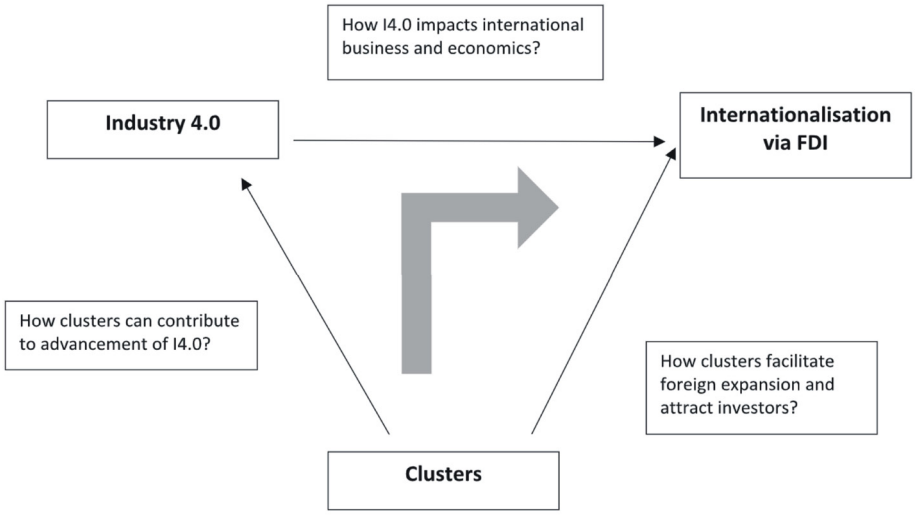

Fig. 1. The analysis triangle: "Clusters-Industry 4.0-Internationalisation"
Source: own work.

Digital technologies can namely have a disruptive impact on the pattern of global and regional production, due to their nature, i.e. the pace, the scope (affecting actually all industries in all countries), and systemic impact (van Tulder *et al.*, 2018; MAKERS). This multifaceted challenge implies high analytical uncertainty. The evaluation of how this impact will proceed eventually can be done only by drawing various scenarios, although, that is burdened with high uncertainty. The final outcome (more polarised world or more dispersed activities) remains unclear, as does the path of the changes – more empowering of small entrepreneurs or stronger MNEs (UNCTAD, 2017; Alcácer *et al.*, 2016). Complex processes associated with I4.0 leading often in opposite directions have their consequences for academics as they result in advancing only highly hypothetical and speculative assumptions.

The available studies indicate the lingering confusion regarding the full influence of I4.0 – understood in terms of both the subsequent new technologies and the organisational changes – on the spatial pattern of economic activity (UNCTAD, 2017; Buckley *et al.*, 2017; Strange and Zuchella, 2017; Hannibal and Knight,

2018; Szalavetz, 2019a, 2019b). In consequence, it remains still open – with new evidence only slowly emerging – whether these processes will reinforce the current regional structure and economic landscape, reconfigure it or rather subvert the existing spatial imbalances (UNCTAD, 2017). In this context, most studies seem to be predicting rather a growth in inequalities and a worsening problem of the asymmetry between the core and the peripheries. That being said, there are also scenarios which assume nimbler and spatially distributed local centres instead of flew large hubs (Strange and Zuchella, 2017; UNCTAD, 2017).

2. INDUSTRY 4.0 WOULD RESHAPE THE INTERNATIONAL BUSINESS

Various concepts and technologies constitute Industry 4.0 (I4.0) or the fourth industrial revolution (Ojra, 2019; Schwab, 2019). They usually encompass: smart factories equipped with sensors and autonomous systems, with the ability to self-optimise and apply autonomous decision-making (Roblek *et al.*, 2016). Industry 4.0 is the embodiment of the fusion of IT and production, of the virtual and the real worlds, a merger of machines, processes, systems and products into smart networks overseeing each other (Kagermann *et al.*, 2013; Hermann *et al.*, 2015). The business digital revolution implies that future manufacturing would be seen as intelligent interconnected technological systems (Brettel *et al.*, 2014; Schwab, 2019; Philbeck and Davis, 2019). The revision of the nature of the competitive advantages of places, strategies of firms, and the architecture and governance structure of IB networks should be anticipated (Alcácer *et al.*, 2016; Strange and Zuchella, 2017). Hannibal and Knight (2018) argued that additive manufacturing (AM) which is inherently related to I4.0 can disrupt the configurations and operations of international business and a specific continuum of households – to global-level manufacturing can be expected. Laplume *et al.* (2016) looked at the impact of additive manufacturing (AM), i.e. 3D printing, on the configuration of GVC arguing that the diffusion of 3D printing technologies may change the role of multinational enterprises as coordinators of GVCs by inducing the engagement of a wider variety of firms, even households. As showed by Buonafede *et al.* (2018), AM has the potential to transform the organisation of GVC forcing MNEs to reinvent their businesses, in particular it could lead to a decrease in a country's participation in GVCs, which demonstrates the likely diminishing reliance on intermediates processed abroad, a falling importance of economies of scale, and (labour) cost-saving strategies. Yet Szalavetz (2018) indicated the impact of advanced manufacturing on the role played by foreign subsidiaries – the production and R&D capabilities and argued that significant upgrading of manufacturing subsidiaries deploying I4.0 technologies would not reduce the gap between lead

companies and manufacturing subsidiaries in terms of value generation (Szalavetz, 2019a, 2019b).

IB research on I4.0 seems to be in its infancy (Chiarvesio and Romanello, 2018) only touching upon some issues, such as the impact of emerging technologies on the structure of global value chains (Laplume *et al.*, 2016; Rehnberg and Ponte, 2016), on the international configuration of companies (Rezk *et al.*, 2016), on multinationals' advantages (Strange and Zucchella, 2017), and on the dynamics of competition (Porter and Heppelmann, 2014). The available studies are often also inconclusive as they cannot identify a clear and direct relationship among investments in Industry 4.0 technologies and international activities (Chiarvesio and Romanello, 2018). The ongoing transformation implies that locational dispersion of activities coordinated by the multinational enterprises (MNE), the competitive advantages of firms, and the structures of IB networks must be adapting. Increasing adoption of modern technology, such as 3D printing enabling additive manufacturing, may at least partially reverse the trend of fragmentation, specialisation and globally dispersed supply chains. Therefore, the GVC's restructuring might result in new geographic landscape rewarding locations close to end-users. On the one hand, new technologies provide new options for dispersed modular activities; on the other, though, they enable the shortening of production stages (Strange and Zuchella, 2017). These processes may increase the power of MNEs as coordinators of GVC, or conversely, empower many small geographically scattered network's or chain's members (UNCTAD WIR, 2017). A certain transition from transactions internalised within MNEs, towards GVC open, international business network structures might be expected. It is reasonable to claim that these fundamental changes and reconfigurations would require and would be accompanied by respective modifications of the antecedents of firms' advantages and localisation attributes. Hence, the fourth industrial revolution would impact the organisation of international business as it would affect the sources of attractiveness of given locations and the roots of firms' competitiveness.

3. CLUSTERS MAY FACILITATE THE DIGITAL TRANSFORMATION AND INDUSTRY 4.0

The findings of previous research demonstrate that despite some perceived incompatibility, clusters and fourth industrial revolution may be reconciled. What is more, clusters can contribute to the development of Industry 4.0 in multiple ways (Götz and Jankowska, 2017). First, our attention should be directed to *knowledge.* The requirements towards cyber physical systems (CPS) which are the backbone of I4.0 are enormous (Monostoria, 2014). These specifications

and properties have obvious repercussions and constitute formidable challenges to scientific and research community. In the light of the complexity of requirements, the knowledge, particularly the uncodified, tacit, available in highly specialised clusters where firms, universities and other entities can work together cannot be underestimated

This importance of proximity – social, cognitive, personal, physical or technological – is further reinforced by the interactive character of learning and idiosyncrasies of knowledge creation, which introduces space as a crucial variable, which must not be neglected even in the era of Industry 4.0 (Leszczyńska and Khachlouf, 2018). The more tacit a piece of knowledge is, the more important geographical closeness and direct interactions become (Cantwell, 1989; Kogut and Zander, 1992). The physical proximity and close multiple interactions, which are characteristic for clusters by dint of to the spatial concentration, can be seen as reflecting the typical for Industry 4.0 merger of stages and functions from R&D to marketing which is facilitated via IT solutions (Kagermann *et al.*, 2013). As I4.0 urges to rethink the current business models, the fractal company offers a promising concept in this respect, which is symbolised by self-similarity, self-organisation, self-optimisation and goal orientation (Warnecke, 1997). A fractal company might be understood in terms of a multi-agent system, where each fractal observes its environment and decides based on the feedback received (Wang *et al.*, 2016). The offers of cluster attributes and coopetition conditions seem to provide the right ecosystem for this kind of interactions (Götz and Jankowska, 2017).

Additionally, it can be argued that clusters imitate also the concept of the connected company which takes form in Industry 4.0. This implies advanced and versatile cooperation of almost everyone with everybody leading to the establishment of a new quality of intertwined relations and vanishing boundaries between firms (Atluri *et al.*, 2017). Experts often stress that the understanding and perception of Industry 4.0 must not be limited just to the digitalisation of production. I4.0 covers the whole ecosystem encompassing people, facilities, machines, technologies, etc. (Agarwal-Brem, 2015; Bharadwaj *et al.*, 2013; Erol *et al.*, 2016) and clusters thanks to the dense web of linkages, spillovers and other externalities may provide such a conducive environment. As the evidence of many clusters show (Bramanti, 2016) clusters can be considered in terms of policy tools organising the pursuit of modern smart reindustrialisation, digital business transformation, and a part of high-tech strategies in many countries (European Cluster Collaboration Platform ECCP).

Summing up, the new advanced technologies facilitating the long-distant communication and collaboration across borders can be reconciled with clusters which can serve as centres of excellence, where the critical for I4.0 knowledge is being developed and perfected. As briefly reviewed by Götz and Jankowska (2017), competence creation, reduced uncertainty or close network relations offered in clusters are just examples of multiple advantages which can facilitate develop-

ment and implementation of the fourth industrial revolution. Clusters can provide a conducive environment which stimulates the discovery, emergence, development and testing of I4.0 technologies. They can act as test beds or laboratories for Industry 4.0 experiments, enabling efficient knowledge creation and dissemination or act as vehicles for the implementation of place-bound smart industrial policies. Clusters can be harnessed as such valuable policy tools with the aim to ensure a smooth implementation of digital transformation, as the Italian law Piano Industria 4.0 or the German leading-edge cluster contest confirm (MAKERS, 2018; Leading-Edge Clusters Competition).

Such initiatives targeting mainly SMEs capitalise on the intrinsic benefits offered by clusters and facilitate more effective employment of the advantages available in clusters in order to foster the business digital transformation. At the same time, they aim to address the emerging I4.0 related challenges such as adequate legal norms, interpretability, skills shortages, unclear and missing definitions or technical standardisation. They also recognise the urgent need of taking into account the idiosyncrasies of domestic companies and acknowledging the territorial specialisations in local context (Cantner *et al.*, 2015). Regardless of the challenges of I4.0, the inherent problems arising due to natural cluster side-effects such as the crowding-out, congestion, members' asymmetry, free riding practices or "job stealing" must be addressed as well (Parrilli, 2019). It should be also noted that the classic concept of a cluster in the I4.0 era seems to face the competition of a new emerging category, i.e. the entrepreneurial ecosystem (Autio *et al*., 2017) which draws on the digital affordances enabling new ways of value capturing and creation. An interesting avenue of study would be, therefore, to investigate the mutual relations between these two concepts.

The distinctive features of clusters and benefits they offer seem aligned with the requirements and challenges posed by I4.0. The following section discusses the role a cluster plays in stimulating the internationalisation processes focusing on the most advanced form, namely on foreign direct investments – both inward and outward (IFDI, OFDI).

4. CLUSTERS CAN INFLUENCE THE FDI AS THEY DETERMINE FIRMS' COMPETITIVENESS AND REGION'S ATTRACTIVENESS

Today, clusters are considered as facilitators of entrepreneurship, creativity, and innovation (Delgado *et al.*, 2014; Florida, 2002; Porter, 1998) and hence as being critical for a country's or region's international competitiveness (Turkina and Van Assche, 2018; Claver-Cortés *et al.*, 2019; Boix and Trullén, 2010; Hervas-Oliver, 2015; Hervas-Oliver and Boix-Domenech, 2013).

4.1. Setting the stage of internationalisation – selected antecedents of FDI

Internationalisation can be understood as an inward and outward involvement in international business (Hessels, 2007; Onetti, *et al.*, 2010). It refers to the adaptation process of the functioning of a firm to the international environment (Chetty and Stangl, 2009). It also manifests itself in the form of resource purchasing as well as selling in international markets (Cassiman and Golovko, 2011). Lam and White (1999) defined internationalisation as a process of increasing a firm's awareness about participation in international activities. Welch and Luostarinen (1988, p. 36) presented firm internationalisation as the process of increasing involvement in international operations. Foreign Direct Investment (FDI) is seen as the most advanced form of internationalisation as it implies the commitment of resources and involves much more risk than other forms of expansion into foreign markets. According to the OECD, FDI is defined as cross-border investment by a resident entity in one economy with the objective of obtaining a lasting interest in an enterprise resident in another economy[2].

The literature on FDI – its antecedents, consequences or models – abounds, and it is certainly beyond the scope of this paper to review even a few selected items. Nonetheless, the seminal contribution to research on FDI was provided by J.H Dunning Investment Development Path (IDP) and Ownership-Localisation-Internalisation (OLI) framework (Dunning, 1993; Narula and Dunning, 2000). The IDP conceptualised that countries tend to go through five main stages of economic development, and these reflect and are closely linked with the propensity of these countries to be outward or/and inward investors (Fonseca *et al.*, 2007). This propensity is related to sets of three advantages: O – ownership advantages of companies, L-location advantages of host economies, as well as on I – internalisation advantages. The empirical elements of conducting FDI and available evidence proved that all three are necessary to explain FDI.

The contemporary literature covers a multiplicity of variations and theoretical considerations as well as empirical evidence on these advantages including further refinements and extensions. Recent papers (Buckley, 2017; Gugler, 2017) clearly indicated the need to expand and develop the research on the role of country-specific advantages and broadly understood home market role in stimulating or preventing the FDI flows via impacting firm specific advantages. The OLI paradigm has been undergoing certain refinements as well. Guisinger (2001) supplemented it to OLMA by adding two more components: *M – mode of entry*, and A – *adaptation* to local environment. Peng (1995) suggested enriching the existing eclectic theory by the so-called learning option advantage.

Besides exploiting the possessed advantages, FDI can be also seen as a vehicle enabling foreign innovations and knowledge abroad and hence facilitating the

[2] https://stats.oecd.org/glossary/detail.asp?ID=1028 [accessed on: 15.08.2019].

learning processes. There are not only refinements of stages of FDI development and diversified relations between the advantages but the importance or even absence of some of them can vary. Cantwell (1989) highlighted that firms start FDI not only with the aim to utilise the capabilities already on hand, but in search of new ones that are not available in their home markets. This motivation has been termed 'technology seeking' or 'knowledge seeking'.

It seems, which available scholarly papers confirm, that the cluster-MNEs relations are very context specific and best when studied when referenced to the method of a case study. In the light of the topic of this paper our further discussion focuses on two advantages, i.e. ownership advantages which explain how a firm's tangible and intangible assets help it to overcome the extra costs of doing business abroad (Reinert, 2012), and location advantages which explain why a home-based MNE chooses to manufacture in a foreign country rather than in its home country. Leaving aside for the brevity of this analysis the multiple interdependencies and intricacies of both advantages, it is necessary to outline the possible cluster's role in shaping them and in consequence the propensity to generate OFDI or attract IFDI in peculiar times of the fourth industrial revolution.

4.2. Internationalisation and clusters

Internationalisation can be broadly defined as "the process through which a firm moves from operating solely in its domestic marketplace to international markets" (Richardson *et al.*, 2012; Javalgi *et al.*, 2003, p. 185). Internationalisation defined in terms of developing links with foreign entities can encompass both the foreign expansion of cluster entities and the attraction of foreign entities into the cluster. While the former from the perspective of cluster inhabitants and a cluster organisation might be labelled as active, outward-oriented internationalisation, the latter can be described as passive, inward-oriented internationalisation (Jankowska and Götz, 2018). The impact of clusters on internationalisation seems to happen via multiple channels (DiMaggio and Powell, 1991; Steiner, 1998; Smith, 2008; Sölvell, 2008; Fornahl and Menzel, 2010; Andersson, 2013; Dohse *et al.*, 2018). Clusters can serve as versatile tools which facilitata both the foreign expansion of domestic firms and the hosting of foreign investors (Gancarczyk and Gancarczyk, 2018; Howells and Hedemann, 2009; Pla-Barber and Alegre, 2007; Zen *et al.*, 2011; Richardson *et al.*, 2012; Dhandapani, *et al.*, 2015; Colovic, Lamotte, 2014). The 'cluster effect' including thick social framework proved to facilitate firm internationalisation, as firms can exchange knowledge and establish close social relationships (Richardson *et al.*, 2012). However, modalities such as the heterogenous type of inventive prowess of firms need to be taken into account when assessing the chances of leveraging the available cluster advantages (Libaers and Meyer, 2011).

Previous studies outlined a simple framework for investigating a cluster's impact on internationalisation (Jankowska and Götz, 2018). They aimed to organise the research on the versatile cluster role in foreign inbound and outbound expansion. It stressed the duality of the cluster concept by highlighting that, on the one hand, these are the natural features of clusters which can facilitate internationalisation of domestic firms, while, on the other hand, it is the dedicated cluster organisation which can foster the foreign expansion of local companies (Fromhold-Eisebith and Eisebith, 2005).

Multiple modes of cluster-related internationalisation could be distinguished. The first channel represents the participation in the internationalisation of clusters as such. These entities often have established brands, they are registered associations or limited liability firms with own management, executive and supervisory boards consisting of representatives of business, R&D sector and regional government authorities. They can themselves be regarded as actors in international relations cooperating with other similar entities. The institutional format may be considered as a proof of the cluster's maturity, though, such official dimension should only complement the natural bottom-up processes leading to cluster emergence and not precede them. The second identified link stresses the internationalisation of cluster members, i.e. its companies. This can be named an outward-looking and active internationalisation as compared to attracting foreign firms from the outside which stands for the inward-looking or passive internationalisation. The expansion of cluster firms into foreign markets might happen indirectly via bottom-up created natural favourable environment or in a more top-down manner by the application of designed and dedicated measures (Nassimbeni and Sartor, 2005; Belussi and Sammarra (eds.), 2010). This assistance might target export or a more advanced form, namely FDI (Gancarczyk and Gancarczyk, 2018; Pavelkova *et al.*, 2016). It is of the highest importance for SMEs and start-ups experiencing the liability of unconnectedness (Baum and Oliver, 1991). A study by Cook *et al.* (2012) demonstrated that clusters do promote OFDI, and the advantages gained in clusters can be the foundations of a successful internationalisation. Clusters can also contribute to the internationalisation processes by attracting foreign firms and their investments – FDI (Malmberg and Maskell, 1999; Guimaraes, 2002; Bekes, 2004; Pandit *et al.*, 2008; Yavan, 2010; Götz *et al.*, 2014; Van den Berg *et al.*, 2001). This pulling effect can be considered in terms of inward-looking, passive internationalisation (more in the following section).

The previous analysis has also sought to determine the antecedents of a cluster's role in internationalisation (Jankowska *et al.*, 2017). It has been argued that the proximity and the critical mass of entities being specialised in a field or industry, in other words, all this what constitutes the backbone of a cluster, enable achieving three main advantages (Götz, 2009), which are: pecuniary agglomeration economies, conducive knowledge environment, and reduced uncertainty. These factors facilitate interactions and cooperation among mainly small and medium firms, tradi-

tionally inhabiting a cluster. More collaboration in turn enables reaching advantages, otherwise beyond the reach for many of these companies due to the their liability of smallness. Knowledge conducive conditions including the spillover processes contribute to innovativeness, whereas pecuniary agglomeration economies and critical mass of specialised entities seem to create the foundations for efficiency advantages (Jankowska *et al.*, 2017). Reduced uncertainty typical for mature clusters with supporting entities such as cluster organisations accompanied by trust relations, mutual understanding, shared values, and norms seem to affect both types of advantages. Therefore, a cluster, by its very nature and idiosyncrasies – specialisation, critical mass, proximity – can offer ecosystem stimulating innovativeness and efficiency, which have an impact on the competitiveness of cluster firms.

Thanks to these advantages, companies are better equipped to internationalise (Humphrey and Schmitz, 2002; Nadvi and Halder, 2005; Bertolini and Giovanetti, 2006; Belderbos *et al.*, 2008; Mudambi and Swift, 2011). If they gain them at home, that fact is regarded as a pre-requisite for a foreign expansion as described in the Uppsala model (Johanson and Vahlne, 2009). The close relationships with other cluster firms additionally shape the advantages, and in the case of internationalisation of one of them, this relationship may work as a springboard for a foreign expansion for other companies (Johanson and Mattson, 1988). This process might be further enhanced by the activities of the cluster organisation, in particular, these focusing on internationalisation (Pavelkova *et al.*, 2016).

Summing up, cluster properties resulting from a spatially concentrated pool of competing and cooperating entities enable achieving concrete advantages. Benefiting from them can materialise via intra-cluster collaboration, which is supported by and also reversely leads to reduced uncertainty, conductive knowledge environment and agglomeration economies. This translates into concrete advantages for SMEs which cannot be underestimated given the liability of smallness from which they often suffer (Aldrich and Auster, 1986; Kale and Arditi, 1998; Hessels and Parker, 2013). The available studies have confirmed that the performance of cluster firms is higher than that of non-cluster ones (Becchetti and Rossi, 2000; Belso-Martinez, 2006) and that such firms internationalise faster (Fernhaber *et al.*, 2007; Zuchella and Servais, 2007).

4.3. Cluster – an attractive place for IFDI

In order to avoid disordered listing of all possible benefits on the one hand, and formulating a statement as unhelpful as "clusters are attractive due to cluster economies / agglomerations form because of agglomeration economies"[3] on the other, three major sources of attractiveness can be distinguished

[3] Actual cit. "So you are telling that agglomerations form because of agglomeration economies" – FUIJTA, M., KRUGMAN, P. and VENABLES, A. (1990), *The Spatial Economy – Cities, Regions, and International Trade*, The MIT Press, Cambridge, p. 4.

(Götz, 2009). As far as the first source is concerned, the need to highlight the agglomeration economies, i.e. the external scale economies accruing to the spatial concentration, is warranted by the fact that they constitute the core of the cluster concept (Porter, 2004) and are the first essential step in a cluster's life-cycle. The theoretical concepts (Marshall's externalities, Porter's competitiveness, as well as the GREMI approach) and the available empirical studies (cluster mapping) confirm the existence of agglomeration economies within clusters. Seen from the perspective of foreign investors, concepts such as efficiency-driven FDI, Knickerbocker's theory of oligopolistic reaction, or Krugman's model of new economic geography can suggest the cluster role in attracting FDI. The benefits of agglomeration economies on FDI are also well documented in many econometrical and statistical studies. It is reasonable to conclude that agglomeration economies present in clusters are of importance for companies pursuing FDI, thus this factor can be perceived as a stimulus for FDI inflow (Götz, 2009).

Broadly understood knowledge as a source of a cluster's attractiveness for FDIs had been distinguished due to the growing role of technology-driven FDIs (Chung and Alcacer, 2002), and an intangible character of this production input including the issue of tacit, sticky, uncodified knowledge (Malmberg and Maskell, 1999; Dunning, 2000; Krugman, 1991; Li and Bathelt, 2018). Theories such as asset-augmenting (exploiting) or knowledge-seeking FDI stipulate the MNEs' interests in gaining access to foreign knowledge sources, whereas Marshall's approach, concepts of regional learning, learning region, or GREMI framework suggest that a cluster may be an environment conducive for knowledge processes. The results of the majority of empirical analyses point to the importance of localised knowledge for foreign investors' decisions (Götz, 2009; Porter, 1998; Storper and Venables, 2004; Belussi and Hervas-Oliver, 2016).

Reduced uncertainty and hence more favourable business conditions can be seen as the third distinct source of a cluster's attractiveness for foreign investors as these suffer the liability of foreigners – they are affected by information asymmetry, higher transaction costs and other problems related to the 'alien status'. This aspect reflects the duality of a cluster's existence – as a 'bottom-up' natural and spontaneous or 'top-down' designed and implemented phenomenon. This source embodies also the idea of 'organising capacity' which as argued by Van den Berg *et al.* (2001) a cluster should provide. This capacity encompassing social support, public-private partnerships, the official strategy, and provided leaderships could alleviate the liability of foreigners experienced by non-local investors and hence contribute to a more friendly business environment.

The reasons of clusters attractiveness for FDI can be surmised as follows. The first factor draws our attention to the financial benefits of an agglomeration of relations between suppliers and recipients and the existence of a specialised labour

market. The second one accentuates the so-called pure technological benefits of agglomeration – the processes of knowledge dissemination. The third one touches upon the issue of the uncertainty felt by foreign investors and the social and institutional dimension of the benefits of agglomeration.

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As it was argued in this section, clusters have the potential to shape the advantages of both – domestic firms (ownership advantages) and hence determine their competitiveness and readiness for international expansion and that of the region as such to attract foreign investors (location advantages). Thus, a cluster can reshape both dimensions of internationalisation – extraversion and introversion aspects of internationalisation processes.

5. DISCUSSION – CLUSTERS IN THE INDUSTRY 4.0 AGE CAN DETERMINE OWNERSHIP AND LOCALISATION ADVANTAGES – ANTECEDENTS OF OFDI AND IFDI

The conceptual consideration presented above confirms the role of clusters for I4.0 and for internationalisation, in particular for FDI (Fig. 2).

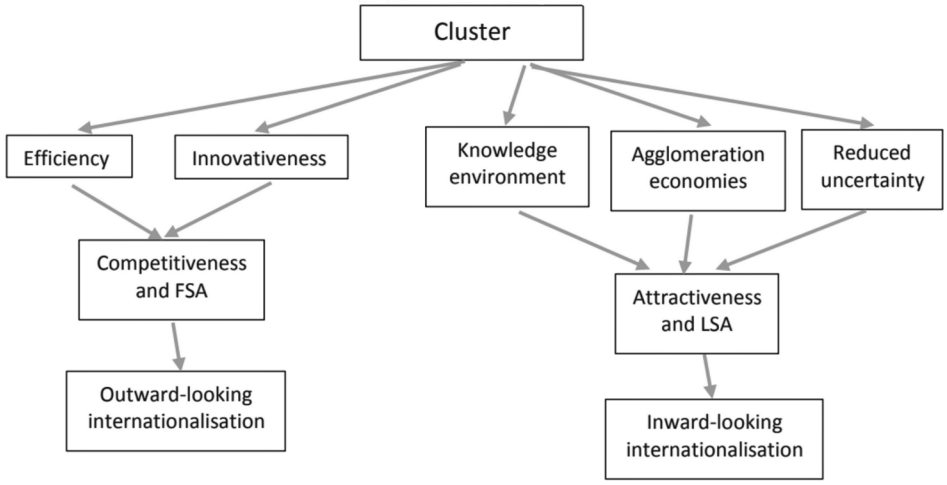

Fig. 2. Cluster impact on internationalisation as diagnosed in earlier studies – summary

Source: own work.

Though, for the moment being as based only on secondary data, it seems difficult to specify the cluster impact on the precise creation of ownership (firm specific) advantages and location advantages separately. Hence, it is difficult to establish the nature or the roots of cluster importance for OFDI on the one hand, and for IFDI on the other hand, during the fourth industrial revolution. As diagnosed in previous studies, clusters can provide a conducive knowledge environment, facilitate the testing of new technologies, and experimenting with new solution by dint of the mutual trust and physical and social proximity. They embody the connected or fractal company characteristic for Industry 4.0 or act as a useful instrument of implementing high-tech strategies of modern, place-bound industrial policies. These findings confirm a cluster's contribution to I4.0 but do not allow to discriminate clearly between creating the ownership or localisation advantages. Thus, it is difficult to distinguish between the impact of the incoming or outflowing investments. The above-mentioned channels seem to shape in the digital era the advantages of domestic companies, members of given cluster, as well as the attractiveness of given region hosting this cluster (see our proposals to be tested – Table 1).

Based on the second-hand data and extant literature one may, however, attempt to specify the channels of influence. It can be speculated that a cluster's diagnosed importance for nurturing the conducive knowledge environment of I4.0 – the centre of competence and the ecosystem of technology transfer – translates into improved innovativeness and hence the competitiveness of cluster inhabitants increasing their specific advantages and thus influencing their propensity of engaging in foreign activities and investing abroad (Zucchella and Siano, 2014; Li and Bathelt, 2018; Mudambi *et al.*, 2018).

Simultaneously, it makes the location more attractive for FDI driven by knowledge-exploring or technology-seeking motivations (Amighini *et al.*, 2013). Recent works not only demonstrated the importance of attracting and absorbing exogenous knowledge, it also stressed the role of anchoring other resources for new path development (Hassink *et al.*, 2019). The fact that clusters epitomise the connected company, or broadly incorporate the merger of functions and blending of activities – so characteristic for digital transformation and vanishing boundaries between sectors – may mean that cluster firms more easily access external scale economies (Marshall, 1920).

Yet a new incoming foreign firm can better benefit from spillovers processes due to lower barriers and synergies effects. The cluster resemblance of fractal company and the provision of coopetition advantages as it seem characteristic for Industry 4.0 may buttress the agility and ambidexterity of domestic firms and by some form of natural selection processes can lead to improved competitiveness facilitating foreign expansion. Such an approach may draw on adaptive processes of internal variation, selection, and retention – VSR (Gong and Hassink, 2019). Foreign investors undergoing the digital transformation when entering clusters can enjoy better takeover options and efficiency gains due to bottom-up rivalry and cooperation, and more flexibility (Fujita *et al.*, 1999; Ando and Kimura, 2003; Mudambi *et al.*, 2018).

Table 1. How clusters might affect internationalisation (OFDI and IFDI) by facilitating I4.0 – research agenda

Channel of cluster impact on I4.0	**Ownership advantage – stimulating OFDI**	**Localisation advantage – attracting IFDI**
Centre of competence and ecosystem of technology transfer	**Innovativeness** and high-tech superiority due to **learning**, shared resources, cheaper access to knowledge base *(increased innovativeness)*	Insourcing, **knowledge exploring, technology-seeking FDI,** leveraging available knowledge, tapping into local know-how *(knowledge environment)*
Connected company and merger of activities	**Externalities** – external scale effects – more easily accessible, flow and exchange of local assets, lower transaction costs, reputational benefits *(increased efficiency)*	**Spillovers** more easily generated and benefited, lower entry barriers, **multiplier effects**, synergies *(agglomeration economies)*
Fractal company and coopetition	Natural selection, solidifying competitive advantages, testing bed for competition oversees, **ambidexterity and agility** *(increased efficiency)*	Better takeover options due to natural selection, **efficiency gains** due to bottom-up rivalry and cooperation *(agglomeration economies)*
Mutual trust, shared norms	**Glue – enabler**, social fabric enabling learning, progress in implementation of risky projects, reduces **liability of smallness** *(increased innovativeness)*	**Social capital facilitates** accessing and sourcing local assets, internalising advantages, assimilating knowledge, impact on **transaction costs and liability of foreignness** *(reduced uncertainty)*
Nodes in networks, core of platforms	**Springboard** for expansion abroad *(increased efficiency)*	**Orchestration**, centre of coordination, pool and hub of dispersed activities *(agglomeration economies)*
Tool of regional policy and place bound industrialisation policy	Modernisation, **scale-up**, co-funding *(increased efficiency)*	Assuring **level playing field**, institutional framework guaranteeing some fair conditions *(reduced uncertainty)*

Source: own work.

A friendly business environment in clusters as a result of shared norms, close interactions, and physical and social proximity facilitates the provision and access to many advantages and in fact enables full participation in learn-

ing processes, the implementation of risky projects, reduces the consequences of the liability of smallness, and equips local firms to better venture in foreign markets (Aldrich and Auster, 1986). At the same time this social fabric and reduced uncertainty can help foreign firms entering a cluster to minimise transactional costs and the perceived liability of foreigners and enable them to better internalise the advantages and assimilating the knowledge so crucial for advancing business digital transformation (Zaheer, 1995; Caves, 1971; Hymer, 1976). If one considers clusters as nodes in networks and core of global platforms, then for local firms they can act as springboards facilitating internationalisation (Osarenkhoe and Fjellström, 2019), whereas they help foreign incoming investors orchestrate the globally dispersed yet thanks to information technologies connected activities (Alcácer *et al.*, 2016). Oinas *et al.* (2018) also acknowledged that regions depend on external connections by acting as hosts of economic nodes differently positioned in global industrial systems either as core, intermediate or peripheral nodes. The fact that clusters are often harnessed to pursue a regional development policy and place-bound policy of modern reindustrialisation may enable local firms to engage in the process of modernisation and scale-up and provide them with funding so necessary for expanding successfully abroad (Van den Berg *et al.*, 1997; Richardson *et al.*, 2012). Then again, it ensures for foreign investors a level playing field and can suggest provision of fair institutional framework reducing uncertainty guaranteeing respecting certain rules (Götz, 2009).

The presented and briefly outlined interdependencies are indeed tentative proposals and for the moment being rather speculations requiring further investigations. Diagnosed in the first part of this paper the channels of a cluster's influence on I4.0 cannot be classified as contributing only or predominately 'to' ownership advantages or localisation advantages and hence as being solely or mainly OFDI or IFDI enablers. Rather, each of the identified channels has a potential to influence the skills and capabilities of domestic companies and their readiness for expansion abroad, as well as the pull power of the hosting region and hence the localisation ability to attract foreign investors. And that is particularly true in the light of the nature of "age of temporary advantage" (Fine, 1998).

6. CONCLUSIONS

Our consideration can confirm a cluster's role for both the advancement of I4.0 and for internationalisation, in particular for FDI. Though, it seems difficult to discriminate based only on secondary data clearly between the cluster importance for OFDI on the one hand, and for IFDI on the other, in the time of the fourth industrial revolution. No good justification could be rigorously found which would enable

classifying some identified channels as affecting solely ownership advantages and hence OFDI and some as impacting clearly only the localisation advantages and hence the IFDI. This problem derives also from the fact that while two out of three components of our introductory 'triangle of analysis', i.e. the impact of a cluster on internationalisation and the role of a cluster in advancing I4.0, do not seem to pose much controversy (or remain better explored), the third element, i.e. the influence of I4.0 on internationalisation, is anything but clear. The scant literature indicates there are more questions than answers in this respect and even that development in conflicting directions may happen. In other words, the impact of the fourth industrial revolution on international business is anything vague (Strange and Zucchella, 2017; UNCTAD, 2017).

The scarce research landscape on the spatial aspects of digital transformation is still eclectic and diverse. The conceptual framework presented in this paper and the derived hypotheses certainly need further testing. However, by focusing on the ownership and localisation advantages as coordinates framing the analysis, this paper seeks to address the emerging calls for more crossings between economic geography and international business (Hervás-Oliver and Alcaide, 2016).

Further detailed studies drawing on in-depth interviews with respective investors or well-designed surveys should provide answers to our research questions and dilemmas. They may, for instance, delve more into the subcategories of a firm's specific advantages with relation to digitalisation (Banalieva and Dhanaraj, 2019). It goes without saying that a precise diagnosis of such avenues and establishing clear channels of influence would have practical managerial implications as well as policy-making implications. Despite some shortcomings, this study may enrich the still scant literature linking digital paradigm shifts with clusters (Osarenkhoe and Fjellström, 2017; Molina-Morales *et al.*, 2017). It may be argued, for instance, that the cluster make-up, the size of population, the type of firms included in it – MNEs or SMEs, or maturity as measured by the cluster age – can act as modulators moderating the identified channels via which clusters can contribute to Industry 4.0 development and in consequence can shape internationalisation processes (Fornahl *et al.*, 2015). The information age, digital business transformation and the related fourth industrial revolution is undoubtedly reshaping current structures, relations, dependencies and processes within international economics and business. The full impact remains still unknown. Scholars are now mainly forwarding research proposals and setting hypotheses as to the most likely directions and the scale of the changes I4.0 may bring. Thus, collecting empirical evidence seems essential for properly diagnosing the challenges, for adequately evaluating the impact of Industry 4.0, as well as for designing optimal policies and adopting the right strategies.

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