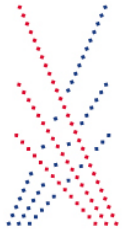

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Latecomer countries in the age of digitalization: case of Russian manufacturing

Research on digital solutions in production with economic impact evaluation of emerging technologies are relatively novel for the academic field. In a broad sense, digitalization could be interpreted as expanding deployment of information and communication technologies in economy sectors, and therefore close interaction between physical and virtual environments (OECD/IEA, 2017). With respect to manufacturing, digital technologies deployment relates to a broad concept of Industry 4.0 or smart (digital) manufacturing that encompasses both technological and organization aspects of companies transformation (Ghobakhloo, 2018; Kamble et al., 2018). Existing literature on the topic addresses a wide range of technologies, like computer modeling (Gilchrist, 2016; Szalavetz, 2016; Tao et al., 2017), cyber-physical systems (Dworschak, Zaiser, 2014; Lee et al., 2015; Esmaeilian et al., 2016), the Internet of things (Kang et al., 2014; Strange, Zucchella, 2017; Wang et al., 2017), cloud computing (Esmaeilian et al., 2016 ; Li et al., 2014), big data (Hu et al., 2014; Lee et al., 2015; Li et al., 2018), augmented reality (Ghobakhloo M., 2018), industrial automation and robotics (Esmaeilian et al., 2016; Strange, Zucchella, 2017; Ghobakhloo, 2018;), additive technologies (Anderl, 2014; Strange, Zucchella, 2017; Esmaeilian et al., 2016).

Emerging technologies influences drastically productivity and change structure of production, allowing for efficiency gain and changing comparative advantages (Audretsch & Ling, 2012). This process is non-linear, since the uptake of new technologies depends on by specific parameters, primarily absorptive capacity (Aristei et al., 2016), as well as expected market potential, level of competition (Boone, 2008; Aristei et al., 2016). In this context, the opportunities for early adopters and technological latecomers are determined by the industry environment (Perez & Soete, 1988; Malerba & Orsenigo, 1996; Breschi et al., 2000). Hence, technological opportunities and appropriability conditions provided a useful framework in explaining different paths in technological uptake between countries and industries (Perez & Soete, 1988; Teece, 1986; Nerkar, 2003).

Due to cross-cutting nature of digital technologies and its longstanding implications the role of government becomes more evident. There is a set of studies discovering developed countries, however digitalization is rapidly expanding in emerging economies, namely BRICS. The academic literature shed light on strategic initiatives, like Made in-China 2025 (e.g. Chen, 2018), the National Network for Manufacturing Innovation institutes of the USA (White House, 2016), and Germany's Industry 4.0 (Fuchs, 2018). However, there is a lack of attention to the emerging countries to catch up with technology leaders.

From the global perspective, Russian manufacturing industries refers to industrialization latecomers (Gerschenkron, 1962; Szirmai, 2012). Nevertheless, digitalization is still a nascent area with fast changing landscape, where to date there is a race to become leaders and laggards in a new wave of industrial "digital" development. There is a chance to overcome existing structural and technological drawbacks by providing an accelerated uptake of digital solutions. Taking into account a limited number of research focused on Russia, this paper sheds light on Russian case of production sectors and its way to digitalization.

Digital agenda becomes a national strategic priority and in 2017 a comprehensive program “Digital Economy of the Russian Federation” was adopted. By 2030, it is expected digital technologies may become a key source of economic growth: from 2017 to 2030 the contribution of sectors’ digital transformation may bring up to 30% increase in the Russian GDP (ISSEK NRU HSE, 2018). Most significant effects related to digital technologies related to value-added could be observed in machinery-building industries and in chemical sector — traditionally technology intensive industries, where total factor productivity and capital input would be higher in comparison with other sectors (ISSEK NRU HSE, 2018).

To this end, the government provides a strong financial support and accumulate other resources in order to achieve longstanding goals. Highly dynamic IT-market for industrial application, availability of public research, strong scientific schools in STEM fields, capable to provide competitive solutions for national production firms are main preconditions for this.

High-tech sectors producing modern equipment gain its place in data-oriented economy (Mayer, 2018). However, according to (Kim and Lee, 2008), most difficult for latecomers in such sectors is to develop high-technology fields. One of the main concern lies in weak demand of domestic products within a country and, thus, weak R&D. Digitalization of manufacturing industries has a potential to reverse the trend to domestically produce equipment, since it facilitates product development and overall transform a production process. Latecomer economies use mostly foreign solutions, which means a high dependence of external technologies (Kim and Lee, 2008). To overcome this, countries strive to develop own competences in priority fields within a country’s innovation system. Along with R&D, another difficult issue is to stimulate demand on new developed solutions across industries.

The purpose of the paper is to assess technological possibilities of the Russian manufacturing to integrate emerging digital technologies and, hence, provide structural upgrading of industries.

Further development on the paper includes several important sections. Firstly, we provide theoretical framework on innovation strategies and technological regimes in machine building industry and ICT-sector (information and communication technologies) and reveal specific characteristic of them and the role of government support. Digitalization issues are closely tied with industrial patterns in latecomers’ countries, thus, it is important to give an overview of both (Foster, Azmeh, 2016). Further, we discuss place of manufacturing industries in digitalization era and future dimensions of its development.

The next section we analyze digitalization and government support of it based on two cases of latecomers’ economies — China and South Korea. More precisely, we examine catch-up strategies of the countries in ICT-sector and machine building, paying attention to firms’ characteristics and policy mechanisms. For the sake of analysis, we take the case of Korea and China as one of the most remarkable examples of successful latecomers in manufacturing. In terms of value-added in 2016 China occupied the first place, while South Korea was on the 5th place, however the share of manufacturing in both countries amounts 27%, while in Germany is only 21% (Levinson, 2018). Such a comparison is expected to give a useful insight on the inherent firms’ characteristics in the sector and on the other hand, reflect mechanisms designed by government in order to establish a favorable environment for technologies development, implementation and usage.

In third section, we assess machinery building sector and ICT, providing information on innovation and overall sectors performance, trade indicators, productivity level. We also shed light on issues related to localization, knowledge transfer and role of foreign technologies in

machine building sectors. The final part includes discussion on the Russian strategy to digitize manufacturing industries in comparison with the cases described in the previous section.

The results of the paper gives a useful insight for policymakers, especially in the age of active digital agenda in national and international levels. It provides several dimensions for updating manufacturing strategies. Our study reveals perspective areas of government support of the sector giving rationale for financial resources dedicated on it and appropriate mechanisms for its successful implementation. The study on catch up in machinery as industry of technology intensive capital goods makes a step in further research of the role of manufacturing sectors in digital economy and its ability to perform a digital transition.

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