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When 'national innovation system' meet 'varieties of capitalism' arguments on labour qualifications: On the skill types and scientific knowledge needed for radical and incremental product innovations

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ABSTRACT

The literatures on 'varieties of capitalism' (VoC) and 'national innovation systems' (NIS) propose very similar arguments about how firms require different types of labour qualifications to pursue strategies of radical product innovation (RPI), incremental product innovation (IPI), and product imitation (PI) respectively. Despite their similar lines of reasoning, however, the VoC scholars are concerned with the skill profiles of a firm's entire workforce, whereas the NIS proponents focus on the knowledge base of scientists. Given that both literatures have developed without explicitly taking the arguments of the neighbouring discipline into account, it is thus unclear whether they explain the same, or different, phenomena. Furthermore, both literatures propose firm level arguments but test them on the basis of macro- rather than micro-level indicators. This paper therefore asks: first, does micro-level evidence support the VoC and NIS arguments that particular types of employee skills and knowledge backgrounds of scientists are needed for different competitive strategies? And, if so, do RPI, IPI, and PI firms need to employ scientists *in combination with* a workforce having the respective qualifications, or is it sufficient if scientists *or* employees alone are adequately qualified. Quantitative analyses indicate that a particular mix of scientific knowledge *combined with* employee skills facilitate RPI, IPI, and PI strategies. The article thus concludes that – despite their similar reasoning – the VoC and the NIS literatures indeed describe different phenomena, without being aware of the synergies created whenever adequate employee and scientific qualifications are hired together.

1. Introduction: two different literatures, one similar argument

Agreement is broad amongst contributors to the competitiveness literature that firms require people with distinct qualifications in order to pursue different product-market strategies. While employees with 'general' or 'multi-tasking' skills are said to be needed for radical product innovation, workers with 'firm-specific' or 'occupational specialization' skills presumably facilitate incremental product innovation. Low qualified and, hence, inexpensive labour is claimed to be required for low cost production based on product imitation.[3]

Despite this general agreement, different strands of the competitiveness literature focus on diverse *holders* of qualifications. While the literature on 'varieties of capitalism' (VoC) proposes arguments about the qualifications of the *overall labour force* of a company,[4] the literature on 'national innovation systems' (NIS) tends to focus on the knowledge base of a *firm's scientists*.[5] More concretely, the VoC literature argues that radical product innovation (RPI) requires *employees* with general skills because they can

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[3] See Porter (1990): 73–76, Freeman and Soete (1997a); Hollingsworth (2000): 626–630, Estevez-Abe et al. (2001), Hall and Soskice (2001a): 36–44, Lindbeck and Snower (2001), Amable (2003), Casper and Whitley (2004), Casper (2007), see also Freeman (1992), Patel and Pavitt (1994): 89–92, Hage and Hollingsworth (2000), Hollingsworth and Hollingsworth (2000), Nooteboom et al. (2007).
[4] See Estevez-Abe et al. (2001), Hall and Soskice (2001a), Iversen and Soskice (2001), Amable (2003), Casper and Whitley (2004), and Casper (2007).
[5] See Freeman and Soete (1997a), Hollingsworth (2000): 626–630, Hollingsworth and Hollingsworth (2000), see also Freeman (1992), Patel and Pavitt (1994): 89–92, and Hage and Hollingsworth (2000).

adapt more easily to constantly changing supplier–producer relationships and market demands which, in turn, are characteristic of this product-market strategy. Specific skills are said to be necessary for incremental product innovation (IPI) because the in-depth knowledge of a company, of its market, its suppliers and customers enables employees to continuously improve products and production processes, and to adopt products to specific customer needs. Furthermore, employees with an in-depth understanding of how their firm operates are able to work autonomously and to take on responsibility. They know, for example, how to rectify mistakes that occur during the production process, which, in turn, contributes to maintaining a high level of product quality. Finally, product imitation (PI) is said to rely on employees with neither general nor specific but with low skills as their salary levels are reduced. Even though low-skilled employees cannot often rectify mistakes that occur during the production process without precise instructions from their superiors, this does not harm the pursuit of PI strategies, as product quality is less important than product costs.[6]

The NIS literature, on the other hand, illustrates how the employment of *scientists* with diverse knowledge backgrounds crucially enables to pursue RPI, IPI, and PI strategies. Scientists with heterogeneous knowledge are said to facilitate RPI as 'it might take an enormous intellectual effort or an extremely creative mind, to identify a potential new combination' (Lundvall, 1992b: 8; see also Johnson, 1992: 29). Scientists who have worked with colleagues from diverse universities, countries, and disciplines – while being rather autonomous from their supervising professor – are more likely to have the necessary, radically innovative potential due to their increased imaginative capacities. Scientists with a homogeneous knowledge base, on the contrary, are found to enable the pursuit of IPI strategies. Since they have worked within the same field of research and the same team for a long time, scientists with homogeneous knowledge have an in-depth understanding of the technological opportunities in this area and are used to cooperating, and to combining their insights, in order to develop incremental innovations. At the same time, they might be so familiar with one environment that they have difficulties to imagine entirely new realities and, thus, lack the creative capacities to come up with radically new ideas. Finally, PI firms do neither require scientists with a heterogeneous nor a homogeneous knowledge base as they imitate the inventions of their competitors. PI strategists thus benefit from not hiring scientists.[7]

Two features of these literatures are particularly noteworthy. First, both literatures do not test their arguments on the basis of micro-, that is, firm-level indicators. Instead, the NIS and VoC literatures start from the observation that the innovative performance and product market strategies of firms vary between countries and seem to be supported by national institutions, including research as well as education and training (E&T) systems. Based on data aggregated at the industry level, both literatures conclude that these institutional differences cause firms to embark on diverse innovation or product market strategies as they facilitate the availability of different factor types, including scientific knowledge and employee skills. With some very few exceptions,[8] micro-level assessments of scientific knowledge and skill profiles are not provided.[9]

Second, even though they both propose similar lines of reasoning, it is unclear whether the NIS and the VoC arguments refer to the same or different phenomena, because the two literatures developed in parallel without explicitly taking the arguments of the neighbouring discipline into account. While the VoC scholars consider the education and training which *employees* receive,[10] the NIS proponents are rather concerned with the career paths of *scientists*.[11] Ultimately, though, the reasoning of both literatures rests on the insight that the increased exposure of people to new ideas – be it in the form of employees changing firms more regularly, be it in the form of scientists being more autonomous and performance oriented in their choice of research projects – is crucial for the emergence of radical innovations. But, do firms need to hire scientists with a particular knowledge profile *in addition to* a workforce with distinct qualifications in order to pursue RPI, IPI, and PI strategies respectively? Or is it sufficient if scientists alone have a particular knowledge base, given that they constitute that employment group with the key capacities for innovation? Or are scientists merely one group of the firm's entire workforces and, hence, require particular skill profiles rather than knowledge backgrounds?

Consequently, this article has two aims. First, it analyses whether micro-level data confirms the NIS and VoC arguments on the importance of different qualification types for RPI, IPI, and PI strategies. Second, the article explores whether the VoC and the NIS literatures explain similar or different phenomena. To these ends, the article studies pharmaceutical firms – including biotech, traditional pharmaceutical, and generics firms – in Germany, Italy, and the UK. *Pharmaceutical* firms are particularly revealing cases to study as the scientifically established notion of a 'new chemical entity' allows the distinction between RPI, IPI, and PI strategies at the firm level.

Furthermore, firms in *different countries* need to be studied so as to reveal whether possible differences in the labour qualifications employed by RPI, IPI, and PI firms result from the competitive strategies of these firms, or from the sheer availability of diverse qualifications due to the country's research and E&T systems. If the employee skills and scientific knowledge employed by RPI, IPI, and PI firms differ between these competitive strategies rather than between countries, we can conclude that firms cannot randomly hire people, but that RPI, IPI, and PI strategies require workforces with distinct qualification profiles. *Germany*, *Italy*, and *the UK* offer most comprehensive insights as these countries are said to have particularly characteristic E&T and research systems providing people with the required qualifications for RPI, IPI, and PI strategies. More precisely, the E&T and research systems of the UK are held to teach employees and scientists mostly qualifications which are required for RPI strategies, whereas Germany's E&T and research systems are found to provide people with the necessary qualifications for IPI strategies. The poorly developed E&T and research systems of Italy, in turn, are said to leave people with neither general nor specific and, hence, low skills, thereby facilitating the pursuit of PI strategies.[12]

[6] See Estevez-Abe et al. (2001): in particular 173-176, Hall and Soskice (2001a): 21–33, 36–44, Casper and Whitley (2004), see also Iversen and Soskice (2001), and Amable (2003).

[7] See Freeman and Soete (1997a): in particular 268–281, Hollingsworth (2000): 626–630, Nooteboom et al. (2007), see also Hollingsworth and Hollingsworth (2000).

[8] See, for example, Hollingsworth and Hollingsworth (2000), Iversen and Soskice (2001), and Nooteboom et al. (2007).

[9] See, for example, Freeman and Soete (1997a), Hage and Hollingsworth (2000), Hollingsworth (2000), Estevez-Abe et al. (2001), Hall and Soskice (2001a), Amable (2003), Casper and Whitley (2004), see also Patel and Pavitt (1994).

[10] See footnote 4.

[11] See footnote 5.

[12] For proponents of these arguments (Keck, 1993; Malerba, 1993; Walker, 1993; Estevez-Abe et al., 2001; Hall and Soskice, 2001a; Amable, 2003; Casper and Whitley, 2004, see also Patel and Pavitt, 1994; Freeman and Soete, 1997b).