Global products from innovation labs in emerging countries: an introduction

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1 Rise of emerging countries in worldwide business and innovation

By 2013, when this special issue was completed, the significance of 'emerging countries' in worldwide business had become undeniable. This phenomenon was even more impressive given that less than 15 years ago, at the end of the 20th century, the so-called 'industrialised advanced nations' seemed to be doing very well, even securing a lock on future business with the establishment of the internet economy, which was thought to give technologically-advanced countries a leg up in the global competition. Yet it may be telling that even the term 'emerging countries' (or 'emerging economies') is hard to define, given the numerous divergent attempts that have been offered (see e.g., the lists produced by the IMF, Columbia University, FTSE, S&P, Dow Jones, and others). We follow here the definitions of the International Monetary Fund (IMF, 2012).

The economic rise of many of these countries started decades ago but became prominent only recently. For instance, the cumulative gross domestic product (GDP) of the BRIC countries (Brazil, Russia, India and China) grew at a compound annual growth rate (CAGR) of 12.05% between 1990 and 2010, while the global triad countries (USA, EU, Japan) grew at only 4.03% (own analysis of UNCTADstat data). Between 1960 and 2009, the share of advanced countries in world GDP dropped from 75% to 57% (Kose and Prasad, 2010), while the share of developing countries in world GDP grew from 17% to almost 40%. Several publications predict that these trends will not only continue, but that the advanced countries will be relegated to a 'minority position' in worldwide business, or that the largest constituent of the emerging world, China, will become the world's biggest economy sooner rather than later (e.g., *The Economist*, 2011). These extrapolations are not only driven by the growth of these countries as markets, but also by their increasing importance as global manufacturing hubs in key growth industries. For instance, over 90% of all photovoltaic products are manufactured in China and exported to the West (Franchini and Fink, 2011), and Indian software powerhouses such as Tata Consultancy Services (TCS), Wipro, and Infosys have dominant positions worldwide. A quick review of the composition of the Forbes 500 by country of origin demonstrates the rise of companies from emerging countries over the years (Table 1). China alone contributed more than half of these 116 companies in 2011 – up from 47 companies in 2005.

Table 1 Companies represented in Forbes 500, by country of origin

Country/year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
USA	*176*	*170*	*162*	*153*	*141*	*139*	*133*
Japan	*81*	*70*	*67*	*64*	*68*	*71*	*68*
Europe (total)	*174*	*177*	*180*	*188*	*182*	*179*	*166*
Germany	37	35	37	37	39	37	34
France	39	38	38	39	40	39	35
Netherlands	14	14	14	13	12	13	12
Switzerland	11	12	13	14	15	15	15
Sweden	7	6	6	6	6	5	3
Other adv. countries	*22*	*22*	*22*	*18*	*20*	*17*	*17*
Emerging countries (total)	*47*	*61*	*69*	*77*	*89*	*94*	*116*
China	16	20	24	29	37	46	61
Korea	11	12	14	15	14	10	14

Source: Compiled by Dr. Simone Corsi while at GLORAD

Vernon's (1966) product life cycle (PLC) theory suggests that product development follows sales and manufacturing into developing markets. Conceptually, the 'local development' spectrum covers cost-based R&D outsourcing, product localisation, local product development, and – ultimately – competence-based R&D for global markets or reverse innovation. Local firms, i.e., companies originating from emerging countries, also engage in product development. In China, this phenomenon was labelled 'indigenous innovation' and supported with science and technology policies since the late 1990s. According to the EU industrial R&D investment scoreboard (European Commission, 2011), in 2011 the USA, Europe, and Japan were leading global R&D investment with

35.1%, 29.0%, and 21.7%, respectively, of the world total, while emerging economies such as Korea and China were still trailing with 3.0% and 1.7%.

The rise of developing countries is not only a matter of scale, as one might assume given the size of the two most populous countries, India and China, but also a matter of scope. The shift to the East is evident from WIPO data. The most prolific PCT applicants were, well into the 2000s, US and European multinationals, but then Japan moved atop of the rankings in 2011. By 2007, Japan had more companies in the top 10 (Panasonic, Fujitsu, and Sony) than any other country, and by 2010 there were only four Western firms left – the rest came from Japan (3), China (2), and Korea (1). China and Korea together doubled their representation in the top-100 from 4 to 8 companies. China had its first top-10 representative in 2001 and first topped the list in 2008 when Huawei became the largest filer of PCT patents worldwide. Overall, China had become the fifth largest PCT filer in the world in 2010, behind Korea but ahead of France and the UK.

Table 2 Number of companies listed as top 100 PCT applicant, sorted by country and year

Country/year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
USA	*32*	*33*	*36*	*38*	*28*	*25*	*22*	*23*
Japan	*27*	*27*	*26*	*27*	*30*	*30*	*34*	*38*
Europe (total)	*35*	*34*	*31*	*29*	*35*	*34*	*34*	*29*
Germany	16	14	14	14	15	14	16	14
France	6	6	5	5	6	8	9	5
Netherlands	3	3	3	4	4	4	2	2
Switzerland	3	3	3	2	3	3	3	4
Sweden	3	3	3	3	3	2	2	1
Other adv. countries	*0*	*0*	*0*	*0*	*1*	*3*	*3*	*2*
Emerging countries (total)	*6*	*6*	*7*	*6*	*6*	*8*	*7*	*8*
China	1	2	2	2	2	3	4	4
Korea	3	4	4	4	4	4	3	4

Source: Compiled by Dr. Simone Corsi while at GLORAD

2 Advances in research on innovation in emerging markets

These emerging market trends have been tracked by researchers of global science and innovation as well. The field of emerging economies developed from with the international business and geopolitical studies disciplines, triggered by the political changes in the 20th century and especially in the aftermath of the Second World War. As one of the early contributors attempting to explain the rise of emerging economies, Lall (1980) dwelt on the possibilities of technology exports from developing economies; also see (Easterlin, 1981). The field developed new momentum in the late 1990s and early 2000s (e.g., Garten, 1996), especially with the notion of BRIC economies (O'Neill, 2001) and Wright et al.'s (2005) milestone paper on emerging market strategies. Global R&D and innovation management scholars initially studied outward internationalisation of R&D to emerging countries. Cantwell (1995) and Prahalad (2004) were among the first to recognise the potential for local innovation in emerging countries. Since then, and

especially since the middle of the first decade of the 21st century, we witness an increase in the research on innovation for emerging countries as well as in emerging countries. As so often, country-specific studies led the field in describing local early-stage phenomena (e.g., Reddy, 1997; Lu, 2000). Subsequently, researchers advanced concepts relating to the role of emerging countries with respect to global R&D locations (e.g., UNCTAD, 2005; von Zedtwitz, 2006), the reversal of innovation flows back to advanced countries (e.g., Immelt et al., 2009; Govindarajan and Ramamurti, 2011), and the specific nature of indigenous forms of innovation (Prahalad and Mashelkar, 2010; Peng et al., 2009; Zeng and Williamson, 2007) as well as new forms of innovation strategies like 'frugal innovation' and their lead market potential (Tiwari and Herstatt, 2013).

For the purpose of our special issue on global products from innovation labs in emerging countries, those innovation flows that emerge from within emerging countries – either as part of local from activity or within subsidiaries of global firms – and ultimately result in products marketed and sold worldwide are of particular interest. Prahalad (2004) and London and Hart (2004) speak of 'bottom of the pyramid innovation' when referring to innovation developed in and targeting the unserved segments of poor people inhabiting emerging economies; while Prahalad (2004) introduces also the notion of 'trickle up innovation' when innovations developed for the bottom of the pyramid successfully flow into markets in the developed world. Innovations adopted first in poor (developing) countries before being adopted in advanced economies are often called 'reverse innovations' (Immelt et al., 2009; Govindarajan and Ramamurti, 2011; Govindarajan and Trimble, 2012). These reverse innovations are often developed in labs hosted by the very markets they target. Besides leveraging proximity between developers, innovators and markets, they exploit country-specific factor conditions, especially low cost of labour. Innovations that are based on a significant cost advantage (Zeng and Williamson, 2007) and are developed in a resource-constrained context (Ray and Ray, 2011), have been characterised as 'frugal innovation' (Tiwari and Herstatt, 2012; Zeschky et al., 2011). Common to all these innovation concepts is the flow of innovation to emanate from an emerging country and spread globally; a challenge to Vernon's original PLC theory but by no means counterintuitive given the rise of emerging countries over the past decade.

Our special issue addresses this new phenomenon of innovation of global products in emerging countries. The paper by Granstrand and Holgersson gives various indications of market and technology diversification as well as of global market and technology convergence (rather than specialisation) in the context of managerial, legal and economic convergence. The results show that different countries focus on a wider but increasingly similar set of markets for R&D outputs in form of patents, which implies increasing intra-national market diversification and inter-national market convergence. The results also show that different countries focus on a wider but (to some extent) increasingly similar set of technologies that are patented, which implies increasing intra-national technology diversification and inter-national technology convergence. In addition, intellectual property (IP) legal convergence takes place as newly industrialised countries (NICs) have strengthened their IP regimes in compliance with TRIPS and subsequently do so in the context of their indigenous innovation policies.

The second paper by Gerybadze and Merk shows that while multinational corporations (MNC) have concentrated R&D investments within advanced countries in the past, a new pattern of R&D internationalisation can be observed since the advent of the new millennium. The authors provide empirical evidence on R&D investments and

patenting activities of multinational firms in emerging countries. MNC are continuously expanding their foreign R&D networks, with a significant share of new projects being located in the BRIC countries. They observe an upgrading of R&D capabilities in formerly less-developed countries that have recently followed a decisive innovation strategy. R&D centres in China, India and other countries attract an increasing number of MNCs willing to invest in more sophisticated offshore projects. The authors further report a clear trend towards stronger involvement of foreign labs in international patent filings based on a sample of 55 MNCs. The paper also provides illustrative case material on selected companies and their country-specific R&D strategies in China and India.

The third paper by Zhou and Minshall takes a closer look into innovative global products from China. They argue that new ventures in developing countries are typically viewed as low-cost product providers that generate technologically similar products to those produced by developed economies. However, they show that some Chinese university spin-outs (USOs), although rare, have adopted a novel 'catch-up' strategy to build global products on the basis of indigenous platform technologies. Based on this observation they develop a conceptual framework to address the question: how do these specific Chinese USOs develop their innovation capabilities to build global products? In order to explore the idiosyncrasies of the specific USOs, the authors use the multiple case studies method. The primary data sources are accessed through semi-structured interviews. In addition, archival data and other materials are used as secondary sources. The study analyses the configuration of capabilities that are needed for idiosyncratic growth, and maps them to the globalisation processes. This paper provides a strategic 'roadmap' as an explanatory guide to entrepreneurs, policy makers and investors to better understand the observed phenomena.

Paper number four is presented by Qi et al. This paper presents a longitudinal case of Motorola's R&D subsidiary in Beijing over the period 1998–2008. Through the construction of key events and changes, the paper unfolds an evolutionary process of Motorola's R&D capability in China. It further explores the mechanisms driving that evolution. The authors find that this specific R&D subsidiary evolved through four stages: from a local adaption unit performing adaptive, peripheral tasks for the local market; to a local development unit, undertaking independent product development tasks for the local market; to a global R&D centre, being a module of global projects for the global market; and, finally, to a global integration centre, playing a leading and centrally-coordinating role in global projects for the global market. A balance between exploitation and exploration is achieved through temporal and domain separations, which, in turn, drive the development of the dynamics of component competences and architectural competences in the evolution.

Similar to the paper of Zhou and Minshall, Wu et al. take a look at product innovation in China. In their work (paper number five) they first argue that the large domestic market of China has provided opportunities for Chinese firms to implement successful product innovations based partially on imported technology. Wu et al. then analyse secondary product innovations as redesigning and reconstructing the original product architecture of first movers in order to adapt to the customer needs in the domestic market. They find that late comers can implement secondary product innovations for the domestic market in three ways: architecture localisation (adjusting to general local needs), customer-triggered special design (changing to penetrate segments with special needs), and derivative integration (reconstructing/recombining components). To support their arguments they analyse secondary product innovation stages in Haier washing

machines. This paper contributes to latecomer market adaption and product architecture issues in addition to the traditional technological catch-up analysis.

Paper number six is presented by Zeschky et al. and takes a closer look at the burgeoning phenomenon of reverse innovation – i.e., innovations which are adopted first in the developing world. While existing literature has extensively discussed the risks and opportunities of reverse innovation for Western multinational companies (MNCs), the authors come to the conclusion that only little empirical insight in the question how reverse innovation is organised in the firm still yet exists. In their article they investigate how Western MNCs of the healthcare and electronics industries organise their international R&D for reverse innovation. Based on insights of four case studies, they find that the location of the product mandate (i.e., at the headquarters or the subsidiary) is independent of the MNC's ability to generate reverse innovation. In contrast, they find that the design and development of reverse product innovations are always located in the MNC's subsidiary based in a resource-constrained environment. Zeschky et al. argue that the development of frugal product innovation capabilities is a critical success factor in the development of reverse innovation. This article holds important implications for theory and management practice.

The last paper is by Jin et al. and discusses patterns of innovation at the firm-level as well as at the national level. Some developing countries are emerging as nexuses in the globalisation of innovation activities, serving as the location for crucial R&D activities from developed multinational firms (DMFs), which are headquartered in developed countries, and spawning emerging multinational firms (EMFs), which are headquartered in developing countries and conduct some of their R&D in developed countries. Jin et al. propose a framework and a methodology to identify international patterns of innovation at the firm-level as well as at the national level. According to a reconstruction of the R&D owner-inventor structure, they develop the analytical framework as a 3×3 matrix and identify three different patterns for both EMFs and DMFs in the organisation of their R&D internationalisation activities. They further derive three patterns from this matrix at the national level to describe the ways how a developing country can reach the global innovation stage. They also use China as a case to verify their framework.

In conclusion, this special issue aims to further the notion of global innovation in the context of emerging markets as a phenomenon global R&D and technology management. While the practice of global R&D is by now well adopted by most multinational firms, our understanding how products and technologies are developed in countries outside the epicentres of technical and innovation know-how such that they are leveraged globally is still evolving.

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