2 Phenomenological Background

2.1 Lead Markets

Extant research into lead markets can be subdivided into a number of categories. In the following, these will be introduced and described in an attempt to fittingly describe the current state of the field and the research work leading up to this status quo. Specifically, the strands of research that laid the foundations for lead market theory will be described (Chapter 2.1.1), and be followed by a section dedicated to the major theory building effort in lead market research undertaken by Marian Beise and fellow researchers (Chapter 2.1.2). It includes recent work that further refines and updates lead market theory, e.g. by portraying the previously understated role that emerging economies may take as lead markets. In a third section, research focused on applying lead market theory to various categories of products, services, and technologies will be portrayed (Chapter 2.1.3). The introduction of lead market theory into policy making, especially within the European Commission, will be described subsequently (Chapter 2.1.4).

The next sections primarily follow a chronological order, starting with predecessor theories, ranging over a very productive theory-building period within the early 2000s, and ending in 2013 with the publication of work related to emerging economies as lead markets. There are, however, temporal overlaps; in particular, the theory building efforts in the first half of the 2000s simultaneously elicited interest both in academia and in the realm of policy making.

2.1.1 Research Leading Up to Lead Market Theory

Lead market theory has been preceded by at least three major ancestral strands of research. First, lead market theory integrates findings about competition for adoption between alternative technologies and the concept of a dominant design, pioneered by Abernathy and Utterback (Abernathy, Utterback 1978). Second, it is connected with earlier research into country-specific innovation systems and international diffusion of innovations. Third, lead market theory relates to research into the internationalization of R&D and the geographic allocation of resources necessary for innovation.

2.1.1.1 Adoption of Competing Technologies and Dominant Designs

In the 1980s, research into the adoption of alternative technologies had shown that – even under the assumption of rationally acting agents – a superior technology would not always triumph over an alternative inferior technology in an adoption process, producing sub-optimal market outcomes due to externalities (Katz, Shapiro 1985). In

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other words, not only the quality of the technology would determine its chance for successful adoption but also external circumstances of its adoption, such as support by external sponsors (Katz, Shapiro 1986). Rosenberg had already noted in 1982 that increased adoption and use of technologies often contributes to technology improvements (Rosenberg 1982). Based on this, Arthur observed that, in the case of several competing technologies, the initial selection of one technology frequently entails the opportunity to improve it more rapidly than its non-adopted alternatives. In turn, this increases the adopted technology's chances of becoming even more attractive and widely adopted "with the other technologies becoming locked out" (Arthur 1989, p. 116). This may indeed also be the case if the selected technology was originally inferior to the alternative ones. Arthur emphasized that an initial adoption advantage of one versus another technology may result from seemingly minor external events (ibid.). Even in case of non-improving technologies there can be network externalities that make the adoption of more prevalent technologies more attractive for a marginal adopter than the adoption of less prevalent technologies (An, Kiefer 1995)[34]. Furthermore, Cowan demonstrated in 1991 that in the face of uncertainty about the relative benefits of competing technologies and sequential adoption "the market will undersupply experimentation" (Cowan 1991, p. 811), effectively selecting technologies too early to assess them without bias and based on their performance. In brief, technology adoption research in the 1990s had come to the conclusion that it was impossible to forecast the victorious technology in an adoption race solely based on the qualities of the competing technologies. This was an important insight because it suggested that other external factors played a role in technology adoption. These results pertaining to technology adoption were later transferred to work on innovation adoption.

In innovation research, Abernathy and Utterback had already in 1978 suggested the concept of a dominant design (Abernathy, Utterback 1978; Abernathy 1978), one out of a number of technological options that becomes the de facto standard in a product category for a period of time. This work was later supported by empirical research by Anderson and Tushman (Anderson, Tushman 1990). Their studies did not only second the notion that dominant designs often lagged behind the technological state of the field – in other words, were inferior technological alternatives – but also offered an evolutionary model, which showed that dominant designs typically emerged after

34 Imagine for example the choice between purchasing a telephone – with estimated more than 1 billion active telephone lines in use (source: Central Intelligence Agency n.d.) – or buying a device based on potentially superior telecommunications technology but without any existing subscriber base.

a technological discontinuity and a phase of "intense technical variation" (Anderson, Tushman 1990, p. 604). Before the backdrop of competing companies in free market economies, the notion of a dominant design was immensely relevant, since – as Anderson and Tushman note – "sales always peak after a dominant design emerges" (ibid.) and the eras of design dominance were shown to typically last several years or even decades.

Taken together, lead market theory would later integrate two of the described insights: First, successful technology adoption is not only dependent on endogenous qualities of a technology (i.e. technological superiority over competing technologies) but also on exogenous factors. Lead market theory would later broaden this concept from pure technology adoption to innovation adoption (e.g. new products and services) and focus on market conditions within different countries as exogenous factors affecting adoption. Second, lead market theory would incorporate the conception of a dominant design that displaces competing designs and serves as a de facto standard within an industry for an extended period of time[35].

2.1.1.2 The International Diffusion of Innovations

In the 1950s, Griliches identified time-delayed adoption patterns of farming equipment in different states of the US, thus implicitly introducing a concept of leading market and lagging markets, albeit regional markets within one country (Griliches 1957). In 1962, Rogers suggested in "Diffusion of Innovations" a bell-curve model of innovation diffusion that featured different groups of adopters (Rogers 1962). Since the 1980s, scholars have increasingly focused on the topic of international diffusion of innovations, realizing that some innovations would become internationally successful despite being faced with different environmental conditions in different countries (Prahalad, Doz 1987; Beise 2001). Moreover, it appeared that some countries repeatedly took a leading role in this international diffusion process, eliciting questions about the causes of this phenomenon and the determinants that set these leading countries apart from others. The term "lead markets" entered academic discourse, however, being used in various ways by different scholars[36]. Yip used the expression to indicate a country where an innovation originated in terms of invention (Yip 1992). Bartlett and Ghoshal, on the other hand, used the term lead markets for country markets that "provide the stimuli for most global products and processes of a multinational company" (Bartlett, Ghoshal 1990, p. 243), proceeding that "local

35 Details for these statements will be provided in Chapter 2.1.2.

36 See also Beise 2004 for an extended discussion on the topic.

innovations in such markets become useful elsewhere as the environmental characteristics that stimulated such innovations diffuse to other locations" (ibid.). This use of the term was also adopted by other scholars, such as Kalish et al. (Kalish et al. 1995) as well as Kotabe and Helsen (Kotabe, Helsen 2007). Takeuchi and Porter advanced the view that the leading markets benefitted from customers particularly willing to experiment with new innovation even at the risk of failures (Takeuchi, Porter 1986; Porter 1990). On a similar note, Vernon had previously considered markets with a large share of high-income customers to be particularly susceptible to the adoption of innovations (Vernon 1966). Other researchers took a more company-internal focus, designating a country lead market in a certain category when a multinational company assigns global product responsibility there (Jeannet 1986; Raffée, Kreutzer 1989).

2.1.1.3 Internationalization of R&D[37]

During the 1990s, the internationalization of R&D activities gained renewed academic interest (Granstrand et al. 1993; Gerybadze, Reger 1999). Granstrand et al. noted in 1993: "It is clear that internationalization of industrial R&D with a few exceptions is a fairly recent phenomenon, which still has not progressed very far on average in absolute terms. However, there are some clear and general long-term trends towards an increasing extent and importance of R&D conducted on an international basis" (Granstrand et al. 1993, p. 413). In particular, there had been a paradigm shift away from the "conventional wisdom" (Granstrand et al. 1993, p. 414) that R&D units should generally be centralized and proximate to the company headquarters of multinational companies. Authors, such as Bartlett, Ghoshal, Doz, and Hedlund, increasingly advocated views that underlined the advantages of decentralized R&D located around the world and not solely in a multinational company's home market (Bartlett 1986; Hedlund 1986; Bartlett, Ghoshal 1989, 1990). There was an increased emphasis on the "sensing" (Doz et al. 2001, p. 7) of unmet customer demands and preferences – in promising markets around the world. Even before that, researchers had been alerted to the circumstance that research and development activities were influenced by their surrounding market conditions. R&D units located near company headquarters were therefore highly exposed and potentially biased toward domestic market conditions (Steele 1975).

Early research into cases of existing international R&D activities had been conducted in the 1970s (Ronstadt 1977; Mansfield et al. 1979). As early as 1981, the analysis of

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37 This chapter benefits much from the work of Granstrand et al. (Granstrand et al. 1993).

internal technology transfer within multinational companies (e.g. Hirschey, Caves 1981) had supported the feasibility of decentralized R&D operations, especially as multinational companies had collected internationalization experience in other corporate functions, such as sales and manufacturing. Therefore, evidence accumulated for both the benefit and the feasibility of international R&D activities[38].

In conclusion, a number of insights preceded the dawn of lead market theory around the millennium: First, adoption competition between alternative technology choices (think "innovation choices") was determined not only by the relative merits of the technologies, but also by contextual factors, such as environmental conditions (think "market conditions" or "demand conditions"). Moreover, adoption-winning technologies typically became dominant and outcompeted alternatives for extended periods of time, frequently due to positive externalities of adoption. Second, some country markets appeared to repeatedly take the role of forerunners with regard to innovation, even if scholars were not unequivocally certain about the causes – some scholars emphasizing a country's strong inventive capabilities, yet others focusing on country-specific adoption advantages. Third, multinational companies had increasing degrees of freedom with regard to location choices for their innovation-driving R&D units, discovering advantages of decentralized R&D locations and – for the process of establishing those remote units – benefitting from previous experience with offshoring sales and manufacturing operations.

2.1.2 The Formalization of Lead Market Theory: Beise and the System of Lead Market Factors[39]

In 2001, German researcher Marian Beise published seminal work on lead markets, integrating previous research into design competition, international diffusion, and the relevance of geographic choices for innovating companies (Beise 2001)[40]. After integrating previous definition attempts into a now widely accepted lead market definition (see Chapter 2.1.2.1) he went on to formalize country-specific market conditions relevant for innovation diffusion into a set of lead market factors, which will

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38 Other authors also suggested competitive advantages based on international diversification but cautioned against the entailing organizational challenges, in particular in product-diversified firms (Hitt et al. 1997).

39 The formalization of lead market theory owes much to the important contributions of Marian Beise – and so does this chapter. For an extensive treatment kindly refer to Beise's original publications, especially Beise 2001, Beise 2004, and Beise 2006.

40 There are earlier contributions by Beise on the topic of lead markets (e.g. Beise, Belitz 1998; Beise 1999), however, not nearly as comprehensive.

be briefly described in Chapter 2.1.2.2. His work includes an extensive case study in the field of cellular telephony that offers empirical evidence for this approach. Furthermore, Beise expounded his thinking on the identification and forecasting of lead markets, which will be summed up in Chapter 2.1.2.3.

2.1.2.1 Lead Market Definition: A Focus on the Demand Side

Beise defined lead markets as having "the characteristic that product or process innovation designs adopted early become the globally dominant design and supersede other innovation designs initially adopted or preferred by other countries" (Beise 2001, p. 10). Therefore, Beise took a strictly demand-oriented view that focuses on the location of adoption rather than the origin of an innovation. Moreover, he was relatively specific in that he prioritizes adoption – a measurable variable – over previous, potentially less definite demand-oriented concepts, such as the "stimuli" proposed by Bartlett[41]. This lead market definition put forward by Beise will be used in the context of this work.

While demand-centered approaches to understanding innovation diffusion may possibly appear unexceptional today, it should be pointed out that this view was a departure from an earlier, supply-centered paradigm. Previous scholars had frequently attributed country differences in innovativeness and innovation diffusion to differences in the availability of technological and scientific capabilities – in other words, differences in supply-side capabilities[42]. Beise's focus on demand conditions was not only reflected in the lead market definition but also in his subsequent description of lead market factors (Beise 2001, pp. 84–108), which almost exclusively relate to demand characteristics of a market rather than capabilities of the supplying parties (e.g. number of engineers and researchers, proprietary knowledge, organizational setup of innovating companies).

In the larger context of a national competitive advantage, Beise suggested that lead market theory is a refinement of the demand advantage originally proposed by Porter as one element of the much-cited "Porter diamond" (Porter 1990; Beise 2004).

2.1.2.2 The System of Lead Market Factors

In the 2001 publication Beise ascribed the development of lead markets to five country-specific lead market factors, which in turn rely on the country's socio-political, ecological, and cultural system. In addition, he acknowledged the roles of additional influences for lead market development: factor conditions, supporting industries,

41 See Chapter 2.1.1.2.

42 See e.g. Posner 1961 and Hufbauer 1966, as cited in Beise 2001.

research infrastructure, and – last but not least – chance (Beise 2001)[43]. Each of the five lead market factors includes a range of sub-factors; in fact, Beise initially referred to lead market factors as "groups of nation-specific characteristics" (Beise 2001, p. 84), accentuating their collective nature.

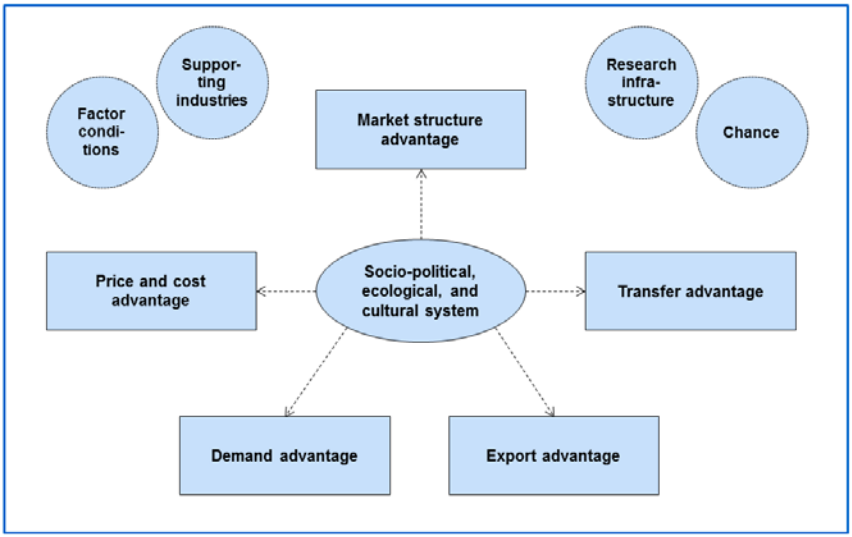


Figure 2: Overview of lead market factors and related factors of national competitiveness[44]

Price advantage, synonymously referred to as cost advantage, includes three sub-factors, namely the *size of demand*, *growth of market*, and *anticipatory factor costs* (Beise 2001, pp. 86–89). Beise emphasizes price advantage as the "most powerful means to overcome international demand differences" (Beise 2001, p. 86). A large size of demand – or domestic market potential – allows relatively quick recovery of the R&D investment required for an innovation and the early attainment of economies of scale in production. Growth of market is particularly relevant with regard to lower switching costs: In a growing market, there are many new adopters of a product or service who have not previously relied on an alternative technology. These new adopters do not have to take into account the switching costs away from legacy

43 Beise is not unambiguously clear with regard to the impact of these four elements on lead market development. Although he introduces these elements early on in his publication, subsequent chapters focusing on lead market identification and lead market forecasting appear to heavily rely on the five lead market factors and less so on these four additional elements.

44 Beise 2001, p. 85. Caption of figure provided as in original source.

technology and are therefore more susceptible to adopt innovations (Beise 2001, p. 88). Anticipatory factor cost occur when the cost structure – e.g. the relative cost of labor and other factors needed to manufacture a product – within a country market anticipates global price trends (Beise 2001, p. 89). As a consequence, innovations that are at a given time particularly cost-effective in a lead market will later also be cost-effective in other country markets, once the local price trend has followed the one in the lead market.

"A demand advantage results from local conditions that facilitate the anticipation of the benefit of nationally preferred innovation designs in foreign markets" (Beise 2001, p. 90). Sub-factors comprise *income*, *anticipatory needs*, and the *anticipatory availability of complementary goods* (Beise 2001, pp. 90–93). High per-capita income may facilitate the adoption of innovations, however, Beise warns that this pertains mainly to "highly superior goods" (Beise 2001, p. 90) and "convenience innovations" (ibid.). Innovations allowing the customer to save cost over previously adopted legacy products, on the other hand, may meet with higher demand in markets with lower per-capita incomes[45]. Anticipatory needs refer to the concept that novel needs arise in a market that will later also arise in other markets. Stimuli for these new needs may emerge in the environment, the economy, or the culture of a country (Beise 2001, p. 91). These stimuli are particularly relevant in case they turn into a global trend later – then, the lead market had a time advantage in addressing these needs and devising innovations to cope with them. Thus, the lead market is well-positioned to export the respective solutions to other countries that are exposed to the global trend eventually. In the context of age-based innovations, an initial hypothesis is that countries undergoing population aging ahead of other countries have an increased potential of becoming lead markets in this product and service category[46]. The anticipatory availability of complementary goods (e.g. cars and gas stations, internet shops and credit cards) amplifies adoption benefits and thus makes adoption more attractive in countries with high availability than in others with fewer available complementary assets.

Transfer advantage relates to the positive impact that a country's adoption decision may have on subsequent adoption decisions in other countries. This includes a variety of effects such as increased awareness for an innovation, a proof of concept

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45 This concept appears at least distantly related to Christensen's notion of low-end disruptions that target customers who will accept lower technological sophistication in return for improved affordability (Christensen, Raynor 2003).

46 This hypothesis requires population aging to be a trend, which (A) affects many countries at (B) different points in time. Details are provided in Chapter 2.2.1.2.

regarding the quality and usability of an innovation, and positive externalities of adoption[47] (Beise 2001, pp. 93–104). Beise differentiates between seven sub-factors contributing to transfer advantage (ibid.): The *international demonstration effect* refers to an increase in international attention for an innovation after its adoption, particularly in other countries with strong communication ties to the initial adopter nation. *Uncertainty reduction* occurs in that the initial adoption of an innovation may demonstrate its usefulness and quality to other potential adopters and thus reduce adoption risk for them. *Global and local externalities* occur when an individual adoption decision increases the adoption benefits for the subsequent adopter (e.g. the benefits of a telephone line depend on the number of already existing telephone lines). Beise points out that such externalities are in many cases local or national rather than global and, as a consequence, may lead to a country's lock-in into a particular innovation design (Beise 2001, p. 96)[48]. *Structure and sophistication of demand* refers to the "users' competence, know-how and former experience with related products or processes" (Beise 2001, p. 97), suggesting that markets may benefit from having critical users that weed out inferior designs. Being known in other countries for having these critical users then increases the probability that an innovation adoption decision is reproduced there. Open designs and technologies that can easily be improved after market introduction are more willingly adopted in foreign countries than *proprietary technologies*. *Multinational firms and mobile users* may act as catalysts in transferring products and technologies abroad, facilitating the adoption process there. *Cross-national policy convergence*, finally, describes the effect of the border-spanning diffusion of policies, e.g. in the field of environmental regulation. These transferred policy changes may also transfer the need for innovations to cope with this new regulatory regime, creating a lead for the country that introduced them first (ibid.).

Export advantage describes factors that facilitate the export of an innovation to other countries, especially relating to the capabilities of domestic firms and to the similarity of market conditions with other countries (Beise 2001, pp. 104–106). Among the three sub-factors, *sensitivity to global problems and needs* represents the level of

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47 See also Chapter 2.1.1.1.

48 This is an important insight, especially in combination with Arthur's thoughts on competing designs (Arthur 1989, see Chapter 2.1.1.1): In a hypothetical two country model, each country may adopt a non-optimal technology due to insufficient assessment of its merits versus alternative ones (Cowan 1991). Then, in addition to the local inefficiencies due to sub-optimal technology choice there will likely be negative externalities due to incompatibilities between the two countries technologies.

interest that companies show in monitoring problems and needs in other countries. The *market orientation of domestic firms*, correspondingly, characterizes how diligently companies develop innovation designs that are "robust" (Beise 2001, p. 105) for export into different environments, e.g. ensuring compatibility with foreign regulatory standards or coping with climate and other environmental conditions abroad. A high degree of *similarity of local demand to foreign market conditions* is said to facilitate border-spanning adoption of innovations, affording countries an advantage when they are similar to other markets in many dimensions, e.g. culturally, socio-politically, or environmentally. It is important to point out that – possibly contrary to intuition – markets exposed to extreme conditions that differ strongly from those in other countries are ceteris paribus provided with lower lead market potential than those with similar conditions (Beise 2001).

A *market structure advantage* occurs in country markets with high levels of competition, where companies try to outcompete each other by means of a fast introduction of innovations and improvements, therefore quickly eliminating inferior designs (Beise 2001, pp. 108–109).

2.1.2.3 Identification and Prediction of Lead Markets

In a chapter termed "Predicting Lead Markets: a Preliminary Approach" (Beise 2001, pp. 234–245) Beise introduces a central problem of lead markets – they can only be identified with certainty from an ex post perspective: Based on adoption and diffusion patterns observed afterwards, lead and lag effects can be documented and analyzed. Ex ante identification – in other words, prediction – of a lead market poses, however, formidable challenges. Beise introduced a suggested methodology ("lead market analysis", Beise 2001, p. 239) based on a structural and two empirical models (exogenous, endogenous) for lead market identification (Figure 3). Essentially, each lead market factor is linked to one or more quantifiable variables, which can be compared between different countries. After a weighting of variables – potentially with the help of a factor analysis – and a weighting of lead market factors, each country's lead market potential[49] can be derived and compared. However, it was also Beise himself who already pointed out a number of weaknesses of this approach (ibid.). In particular, the selection of variables, the weighting of variables, and the

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49 Please note that Beise alludes to the non-determinate nature of the result of such analysis in using the term "lead market potential" (Beise 2001, p. 239) instead of more determinist terms: In cases of countries of similar lead market potentials it is by no means clear that a nation with a slight advantage actually turns into a lead market. Instead, another country of similar lead market potential may become a lead market.

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