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Why locate manufacturing in a high-cost country? A case study of 35 production location decisions

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ABSTRACT

In this paper, we examine in detail 35 final assembly location decisions to gain understanding of the manufacturing location decision from strategy and economic policy perspectives. We are particularly interested in the decision to locate final assembly specifically in a high-cost (high GDP per capita) environment. In contrast with the earlier literature, we focus not just on manufacturing activities themselves, but also the key linkages between production, market, supply chain, and product development. These linkages are examined using three key concepts from theories of organization design: formalization, specificity, and coupling. Using these concepts, an analysis of the micro-structure of each case reveals important commonalities that inform our understanding of location decisions. We conclude by discussing the policy implications of our findings.

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1. Introduction

What explains the decision to locate manufacturing in a specific geographic region or country? The literature on location decisions is as massive as it is diverse, but two recent phenomena warrant a re-examination of the topic. One is the notion of *reshoring* (Ellram et al., 2013; Gray et al., 2017): some Western manufacturers are "bringing manufacturing back home," but our understanding of why exactly this occurs is limited. Another is the claim by Brynjolfsson and Saunders (2009), who noted that we knew *more* about the drivers of economic value in the 1980s than we do today. Location decisions must be understood not just through the lens of economic attractiveness of one region or country over another, but also as a decision where many organizational and technological interdependencies become relevant: decisions about where to locate manufacturing link to other decisions, such as location of research and development activities (Rafii, 1995; Spring et al., 2017).

In this paper, we examine the interdependencies of production with other value chain[1] activities and actors, such as product development, suppliers, and markets. The question "What kind of production takes place in a high-cost environment?" is of special interest. In our analysis, *high cost* is operationally equivalent to high Gross Domestic Product (GDP) per capita. A high GDP per capita tends to correlate positively with the price levels of strategically relevant input factors such as wages. Indeed, the distinction between high and low cost has always been implicitly a distinction between high and low wages.[2] The United States, Finland,

[1] In our terminology, *value chain* consists of all the activities related to the ideation, development, manufacture and sale of industrial products (Porter, 1985). *Supply chain*, in turn, encompasses those activities of the value chain that are directly related to the manufacture of the product and its components; R&D is thus *not* considered to be part of the supply chain. In this paper, supply chain management means primarily management of the supplier relationships between the final assembler and the first-tier supplier base.

[2] One might rightly question the value of the continuing use of this distinction. In what sense do low-cost countries like China offer cheap labor? According to World Bank statistics, China's GDP per capita doubled (from $3414 to $6807) in the five-year period of 2008–2013. This has been associated with roughly commensurate changes in wages as well: U.S. National Bureau of Statistics reported a 71 percent increase in wages in China's manufacturing sector in the same five-year period. In the same five-year period, both the GDP per capita as well as manufacturing wages remained stable, even declined, in many Western economies.

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Switzerland, and Singapore are examples of high-cost environments. Our sample cases are firms headquartered in a high-cost country (Finland). Most of these firms have, or have had in the past, production both in high- and low-cost countries. Analysis of their location decisions can thus shed important light on the determinants of these decisions.

A second aim of our inquiry is to examine the policy implications of location decisions: When and why should policy makers be interested in production location decisions? Understanding value creation is central to understanding the role of production both within a firm and within a national economy. Employment is obviously relevant, but if the goal is to understand and to foster *economic growth*, one must understand how economic actors add value to the economy in which they operate. Understanding an economy (and economic policy) requires that we understand where value —gross output less intermediate consumption—is added.

Our results suggest that contemporary location decisions link intimately to three dimensions of interdependence with suppliers, market, and development activities: formalization, coupling, and specificity. We propose these as important new categories both for firm strategy and economic policy, because they link only weakly to the more salient strategy and policy dimensions such as industry, firm size, and value added. In sum, our results show that in order to understand why firms locate their activities in high-cost countries, we must understand the interdependencies in the value chain.

2. Elaborating our understanding of location decisions

An extensive literature on the geography of economic activities spans several decades and multiple disciplines (Buckley and Casson, 1998; Chen et al., 2014; Dunning, 1988; Ferdows, 1989; Johanson and Vahlne, 1977; Mueller and Morgan, 1962; Rugman and Verbeke, 2001; Schmenner, 1982b). In this literature, we identify three distinct approaches that approach the question from different perspectives.

What we refer to as *the locational perspective* seeks to identify the locational factors that attract (or dissuade) manufacturing investment. Access to various "immobile factor endowments" (Dunning, 1988: 4) such as developed infrastructure (Brush et al., 1999) and advantageous labor costs (Mueller and Morgan, 1962) are identified in this stream of literature as pertinent in location decisions. Research based on the locational perspective applies the following principle:

Principle 1:

Decisions about the geography of economic activity are guided by locational factors, such as proximity to markets, access to knowledge, and the relative cost of production inputs.

The second approach, pioneered by Schmenner (1982a) and Ferdows (1989), could be labeled *the organizational perspective* because of its aim to understand how corporations or business units with multiple manufacturing plants are structured with respect to the roles assigned to individual plants. The essential question is how manufacturing is geographically organized within the firm. Accordingly, this approach emphasizes that "the reasons for establishing a factory abroad determine the way the company should plan, design, construct, and commission that factory. What is the strategic role of the factory—that is the starting question" (Ferdows, 1989: 5). A parallel stream in the international strategy literature examines the internal differentiation of subsidiaries in multinational companies, focusing specifically on organization design and structure (e.g., Ghoshal and Nohria, 1989). As to the importance of the perspective, some authors argue that "*internal* corporate considerations are more important than external, environmental factors in influencing the pattern of corporate R&D location […] proximity to headquarters units and manufacturing plants appears to dominate the R&D location decision." (Howells, 1990: 139). Research based on the organizational perspective applies the following principle:

Principle 2:

Decisions about the geography of economic activity are guided by organizational factors, such as plant roles in the firm's network and inter-functional interdependencies.

The third approach could be labeled *the temporal perspective*, because of its focus on time. The fundamental idea is succinctly captured by Stalk (1988: 45): "While time is a basic business performance variable, management seldom monitors its consumption explicitly—almost never with the same precision accorded sales and costs. Yet time is a more critical competitive yardstick than traditional financial measurements." Research using this approach takes time as the central variable and examines issues such as time-based competition, lead times, demand patterns, and industry dynamics. The temporal perspective provides an implicit antithesis to the locational perspective, because it highlights the idea that production costs (a locational factor) may not be as pertinent as logistical costs. Indeed, focus on production costs misses much of the costs that link to time. As the classic *Sport Obermeyer* (Hammond and Raman, 1994) and *Zara* (Ferdows et al., 2004) cases aptly illustrate, production location decisions can have a fundamental impact on lead times and competitive success. The temporal perspective is important particularly in situations in which lead times matter (de Treville et al., 2014). We can thus formulate the third principle, based on the temporal perspective:

Principle 3:

Decisions about the geography of economic activity are guided by temporal considerations.

2.1. What is missing?

The three perspectives described above are academic paradigms in that they focus on how *scholars* think of location decisions. But how do *managers* think? In this paper, we take a more data-driven approach that takes the paradigms into consideration, but at the same time asks critical questions: Do managers really analyze and rank locational factors? Which factors are considered? How many at a time? Many empirical research articles assume that managers consider locational factors fully rationally, and are able to examine their importance either one at a time or by pitting several of them against one another. Brush et al. (1999: 130), for instance, asked managers to explicate the extent to which a given factor (e.g., tax considerations) influenced the location decision. While asking questions such as "How important are tax considerations in making the location decision?" serves a useful purpose, forcing informants to address issues sequentially may be misleading if the goal is to understand the decision. Much of the research on location decisions does not really address *decisions*, but rather general factors guiding them.

A second concern pertains to the level of analysis. How much insight on location decisions can be gained at a general, abstract level that ignores the micro-level context? An individual firm may make hundreds of different location decisions for hundreds of

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different products (Gray et al., 2013). Therefore, in order to understand location decisions, one might examine the location decision for *an individual product*, and whatever factors are examined, they should be examined in the context of this specific product.

A third concern is the application of econometric techniques. The standard practice of formulating an econometric regression model forces the researcher to model the effects of exogenous variables independently of one another, or by way of simple (linear-by-linear) interactions. But in authentic decision situations, it is almost certain that the interactions are much more complicated than our models are able to incorporate. Perhaps in one case one factor (e.g., tax laws) trumps others; in another case several factors (e.g., market proximity and access to skilled labor) may have a joint effect; in yet another case one factor pulls in one direction but two others in the opposite direction (e.g., a region may offer low-cost labor but the distance to markets is high). The literature on location decisions seldom addresses such tradeoffs, tensions, and conflicts. In this paper, we make the conscious choice of aiming for *accuracy*, described by Langley (1999: 694) as "[sticking] closely to the original data."

A fourth concern is that we are working with premises rather than facts. Insofar as the aim is to understand authentic decisions, we must consider the fact that decisions are made by boundedly rational agents who base decisions on "factual premises" (i.e., belief) rather than facts (Simon, 1997: 69). The distinction is crucial. To illustrate, a statement by an executive that "the reason for locating manufacturing in China is because it offers lower costs," must be analyzed not as a fact but as a belief. We became aware of this when we serendipitously had a chance to discuss the paper with a former Chairman of the Board of one of the companies in our study. As one of the authors was discussing the results of the specific company with her, she noticed that coupling of the Production-Development Dyad was rated by company managers interviewed as "negligible." Her immediate reaction was intriguing: "yes, I know that this is what the managers think, but it is wrong." In sum, our analyses in this paper focus exclusively on how managers think and how they make decisions, not what is factually correct. In the context of location decisions, we have evidence that decision-makers are often significantly ill informed, myopic, and biased in their decisions (Gray et al., 2013: 30). But these boundedly rational managers are also the most important source of our data. This makes prescription in particular very challenging.

In this paper, the main focus is on understanding the authentic decision. We acknowledge that all three extant paradigms may have something to offer, but want to privilege the actual decision over any pre-existing schemas or hypotheses. We label our approach *the decision perspective*, which is contrasted with the three extant perspectives in Table 1 and discussed in detail in the following section.

3. The decision perspective

The decision approach builds on the strategic decision-making literature in general and the *behavioral theory of the firm* (Cyert & March 1992) in particular. In this approach, we start from an empirical premise: we go to an industrial firm, identify a product of interest, and then start asking questions about where the final stage of production for that particular product within a particular firm takes place. The point of departure is not a theoretical premise, a hypothesis, or the research literature, but *an actual location decision*. In order to understand the decision, we talk to key informants, examine documentation, or engage in whatever activity that helps us understand how the managers in charge arrived at the specific decision (cf. Bromiley, 1986). For instance, when we approached Nokia, we did not ask "How important is labor cost in your location decisions?" or "Where would you build your next plant?" but instead, "Why was the final assembly of the Nokia 1200 model located in India?" We want to understand why and how firms made a specific decision about locating manufacturing in a specific location.

3.1. Preparation: general framework and a priori concepts

Before embarking on the empirical analysis, we introduce the general framework and concepts used to address the question. We felt that in order to be able to compare and contrast the 35 cases examined, we needed some a priori conceptual structure to our inquiry. We decided to consider the location decision in the context of the value chain. The resulting framework (shown in Fig. 1) allows us to examine the cases within a single framework that is general enough so as not to rule out anything potentially significant. Our focus is on the final production stage. In this paper, by *production* we mean specifically the *final stage* of production. Therefore, production location decision is synonymous to location of the final stage of production, for instance, final assembly.

We used the existing literature on supply chain management, value chains, and innovation, to place production in a broader framework of activities, examining the link between production and the supplier base (first-tier suppliers), product and process development, and the market. The essence of Fig. 1 lies in the three dyadic relationships: *Production-Supply*, *Production-Development*, and *Production-Market*.

We felt the dyads in particular required a priori conceptual elaboration: Insofar as the location decision is concerned, what is relevant in a general sense? We conducted a number of brainstorming workshops within our interdisciplinary research team consisting of economists, organization theorists, and operations management researchers, and arrived at the following key questions and associated key concepts, all of which are all well established in economic theories of the firm as well as organization theory.

1. What is the nature of the interdependence between the two nodes in the dyad? This introduces the concept of *coupling*.
2. To what extent are activities in the dyad routinized? How important are standard operating procedures, for instance? This introduces the concept of *formalization*.
3. How idiosyncratic is the relationship? How easily could one of the nodes in the dyad be replaced (e.g., switching a supplier)? This introduces the concept of *specificity*.

3.1.1. Coupling

Coupling is a central concept in organization theory, typically used to conceptualize essential features of the interdependence between two entities, and often described on the loose-tight continuum (Weick, 1976). In a loosely coupled system, entities within the system can operate independently of one another, that is, decisions about one sub-entity can be made independently of decisions about other sub-entities. In our analysis, coupling is relevant in all three linkages depicted in Fig. 1. Tight coupling is associated with various inseparabilities, functional interdependencies, integrated products, integrated value chains, and vertical integration.

In the case of the Production-Supply Dyad, coupling links to product architectures, specifically whether the product is modular or integrated, which determines the degree to which decisions about components and sub-assemblies can be made independently (Sanchez and Mahoney, 1996; Ulrich and Ellison, 2005).

In the case of the Production-Development Dyad, coupling relates to the interdependencies in the production-development

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Table 1
The geography of economic Activities: Four perspectives.

Perspective	Focus	Key Words and Concepts	Theoretical Foundation and Exemplary Empirical Contributions
Location	Location-specific factors that attract/dissuade manufacturing investments. Examples of locational pulls are cost of labor and tax incentives.	agglomeration economies; comparative advantages; factors of production; locational pulls	Badri et al. (1995); Belderbos and Sleuwaegen (2005); Bhatnagar et al. (2003); Brush et al. (1999); Ellram et al. (2013); Feldmann and Olhager (2013); MacCarthy and Atthirawong (2003); Yoshida (1987)
Organization	Internal structure of the firm, and the roles that different manufacturing plants have in the company's manufacturing network.	differentiation; factory networks; firm-level factors; integration; interdependencies organization; plant roles	Ferdows (1989); Ghoshal and Nohria (1989); Howells (1990); Khurana and Talbot (1998); Maritan et al. (2004); Rugman and Verbeke (2001); Schmenner (1982b); Vereecke and Van Dierdonck (2002), Vereecke et al. (2006)
Temporal	The implications of location decisions for the company's key processes, such as purchasing and delivery. Time is essential.	clockspeed; lead time; quick-response manufacturing; time-based competition	Blackburn (2012); Contreras et al. (2012); de Treville et al. (2014); Ferdows et al. (2004); Fine (1998, 2000); Holweg et al. (2011); Suri (1998); Stalk (1988)
Decision	Understanding the actual decision made about a specific product. Seeks primarily empirical rigor, and does not privilege any a priori theoretical approach.	bounded rationality; decision making; information processing	Bromiley (1986); Cyert and March (1992); Dean and Sharfman (1993); Marucheck et al. (1990); Menda and Dilts (1997); Mills et al. (1998); Simon (1997)

functional interface. Coupling is tightest in the case of reciprocal functional interdependencies that call for heavy-duty cross-functional efforts, joint problem solving, and non-modular (more integral) organization designs (Lawrence and Lorsch, 1967; Sanchez and Mahoney, 1996; Swink et al., 2007; Thompson, 1967). Tight coupling may also require collocation of product development and production (Ketokivi and Ali-Yrkkö, 2009; Pisano and Shih, 2012).

Finally, in the case of the Production-Market Dyad, tight coupling places production in the proximity to the market due to factors such as logistics costs, legal requirements to produce locally, or the simple fact that understanding the market may require manufacturing presence in the market. Loose coupling in turn means production location decisions can be made independently of market location (Gray et al., 2017).

3.1.2. *Specificity*

Specificity is a key concept in economic theories of the firm (Williamson, 1985). A relationship exhibits specificity when the resource profiles of dyad members are shaped by the relationship. A supplier may, for instance, commit to a relation-specific investment by building a component plant right next to the customer's final assembly plant. Low specificity in turn links to multiple

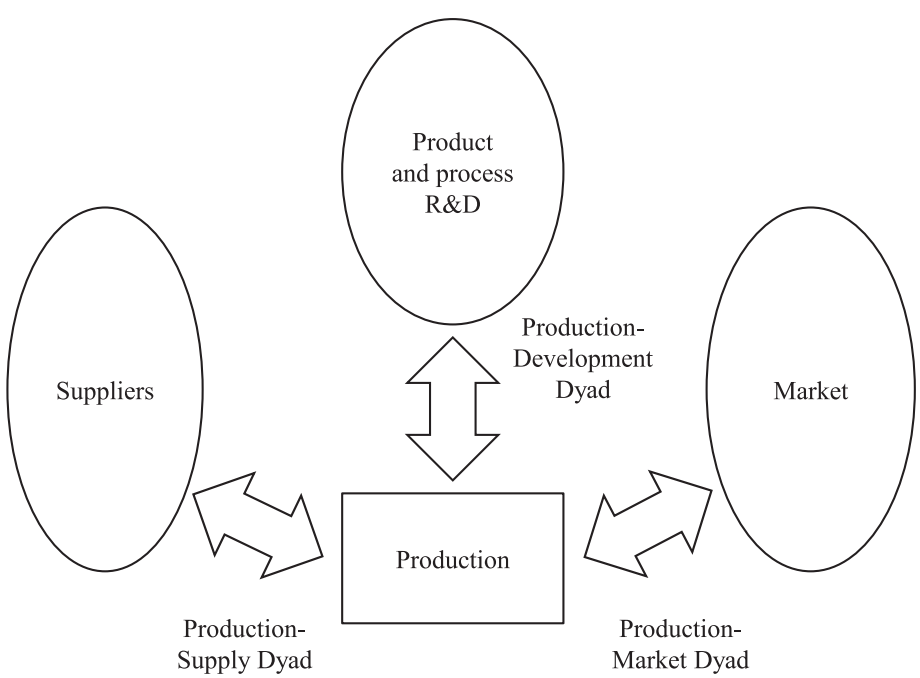

Fig. 1. The general framework.

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suppliers, competition, and mature technologies available for off-the-shelf purchase in the input markets.

Specificity is most conspicuous in the Production-Supply Dyad: Specificity is at its lowest when the supplier-production relationship is governed through market contracts and there are multiple suppliers. At the other extreme are highly specialized supply chain relationships in which suppliers make highly customer-specific investments.

In the Production-Development Dyad, specificity relates to the degree to which development activities are production specific, or require an intimate understanding of production. When development efforts are production specific (as in process development), development and production expertise overlap.

Finally, in the case of the Production-Market Dyad, specificity relates to the extent that individual products need to respond to the needs of local markets (Prahalad and Doz, 1987). At one extreme are global products that require little or no responsiveness. At the other extreme are products that are tailored to the needs of specific regions and that may require various post-production services throughout the product life cycle. In contrast with pure production decisions, location decisions that involve services tend to link to various cultural factors, which are more idiosyncratic (Hahn and Bunyaratavej, 2010).

3.1.3. Formalization

A formalized activity is one that is performed by observing predetermined rules. Formalization links to codifiability, which leads to repeatability and efficiency in performing recurring activities. In our analysis, the codifiability aspect of formalization is central: A codifiable activity is more likely to be transferable. Formalized tasks are easier to adopt and learn, which makes formalization effective in geographic expansion of activities (Bohn, 1994).

A high degree of formalization in the Production-Supply Dyad means standard operating procedures can be applied across organizational boundaries as well. In contrast, low formalization requires manufacturing to order (MTO) or even engineer to order (ETO), which implies closer collaboration with the supplier. Generally, when activities become formalized, the requisite knowledge for executing the activities can be codified (Bohn, 1994). In the context of supply chain relationships, highly formalized relationships lower supplier switching costs.

Production-Development Dyads also vary in their degree of formalization. Application of the Stage-Gate methodology (Cooper, 1990) is perhaps the most widely known method of formalizing product development. At the same time, it is well known that formalization does not always work, and instead, less formal, iterative methods must be employed (Clark and Wheelwright, 1993).

Finally, the Production-Market Dyad may be formalized particularly in situations in which the product offered is standardized and does not need to be adapted to local needs. Similarly, the delivery processes can vary in the degree of formalization.

4. Empirical data

The empirical material for this paper comes from an in-depth study of 35 different value chains. The data were collected in 2011–2013. Despite the unusually large number of cases and the theory-elaborating emphasis, the logic of the data collection resembles that of a multiple case study (Eisenhardt, 1989). The key sampling criterion derives from the special issue focus: We sampled industrial firms headquartered in a high-cost country (Finland). Again in the spirit of the special issue, we focused primarily on firms that have (or at least recently have had in the past) manufacturing operations in Finland. Particularly interesting are cases where the firm has manufacturing activities *both* in Finland and abroad or where production has been relocated from Finland to overseas, or vice versa. Several cases fill these criteria. The sample is summarized in Tables 2 and 3. Some of the case companies are declassified (e.g., *Nokia* and *Helkama*), but others are described only in very general terms (e.g., "consumer electronics products") to ensure anonymity. Table 1 shows that we have considered a wide variety of cases and industries.

The first key variable in Table 3 is *production geography*: Where is the final stage of production located? In 17 cases, this location was the high-cost country. These 17 cases help shed light on the conditions that enable or necessitate locating manufacturing in the high-cost country. In 11 cases, production of similar products takes place both in the high-cost and the low-cost country. Location decisions are thus not necessarily characterized by the idea that manufacturing takes place in *either* a low-cost *or* a high-cost country.

Another key variable is *vertical integration*. In this context vertical integration pertains to whether the final stage of production is outsourced or done in house. Outsourcing is an indication that manufacturing can be separated from other firm activities, which links vertical integration to the key concept of *coupling*.

Production type is a relevant variable, because it links to the degree of complexity in all the relationships in Fig. 1: When products are engineered to order (ETO), the information intensity between product development and manufacturing will be higher, which may necessitate co-location of R&D and manufacturing (Ketokivi and Ali-Yrkkö, 2009). Production type also links to the key concept of *formalization*: ETO tends to be less formalized than make to stock (MTS).

Supply-chain governance is relevant to understanding the

Table 2
Description of cases.

Case	Description
Bread	Basic staple bread product
Candy	Candy bag
Cardboard A	Cardboard
Cardboard B	Cardboard
Chicken	Pre-packaged chicken strips
Chocolate	Chocolate bar
ConsumerTech A	Consumer electronics product
ConsumerTech B	Consumer electronics product
ConsumerTech C	Consumer electronics product
ConsumerTech D	Consumer electronics product
Drill	Specialty drill bit
Heating A	Heating system subassembly 1
Heating B	Heating system subassembly 2
Helkama	Helkama bicycle
Jam	Jam
Marine A	Subassembly for marine engine
Marine B	Subassembly for marine engine
MaterialHandling	Material-handling equipment
Meat	Processed meat product
Nokia 1100	Nokia 1100 cell phone
Nokia 1200	Nokia 1200 cell phone
Nokia 3310	Nokia 3310 cell phone
Off-road A	Off-road utility vehicle 1
Off-road B	Off-road utility vehicle 2
PaperProduct A	Subassembly for paper mill 1
PaperProduct B	Subassembly for paper mill 2
Ponsse	Forest tractor
Steel	Steel product
Textile A	Textile product
Textile B	Textile product
Textile C	Textile product
Textile D	Textile product
Timber	2 × 4 timber
Toast	Toast
TV Dinner	Ready-to-eat meal

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Table 3
Sample and key variables summarized.

Case	Production				Formalization				Coupling				Specificity			
	Location	Type	in house/ outsourced	Supply chain structure	Production	Production-Supply	Production-Market	Production-Development	Production	Production-Supply	Production-Market	Production-Development	Production	Production-Supply	Production-Market	Production-Development
Timber	H	MTS	I	MKT	1	1	1	1	3	1	3	1	1	1	1	1
ConsumerTech A	H	ATO	I	REL	1	2	1	3	1	3	2	3	1	2	2	3
ConsumerTech B	H	ATO	I	REL	1	2	1	3	1	3	2	3	1	2	2	3
ConsumerTech C	H	ATO	I	REL	1	2	1	3	1	3	2	3	1	2	2	3
Ponsse	H	ETO	I	COM	3	3	3	3	1	3	2	3	2	2	3	2
Chicken	H	MTS	I	CAP	1	1	1	1	3	1	3	1	1	1	1	1
Jam	H	MTS	I	CAP	1	1	1	1	3	1	2	1	1	1	1	1
Meat	H	MTS	I	CAP	1	1	1	1	3	1	3	1	1	1	1	1
Meal	H	MTS	I	CAP	1	1	1	1	3	1	2	1	1	1	1	1
Candy	H	MTS	I	MKT	1	1	1	1	3	1	2	1	1	1	1	1
Bread	H	MTS	I	MKT	1	1	1	1	2	1	3	1	1	1	1	1
Toast	H	MTS	I	MKT	1	1	1	1	2	1	3	1	3	1	1	1
Chocolate	H	MTS	I	REL	1	1	1	1	2	1	2	1	1	1	1	1
PaperProduct A	H	MTO	O	REL	3	1	2	2	2	1	2	1	2	1	2	1
PaperProduct B	H	MTO	O	REL	3	1	2	2	2	1	2	1	2	1	2	1
Cardboard A	H	MTS	I	MKT	1	1	1	1	2	1	1	1	2	2	1	1
Cardboard B	H	MTS	I	MKT	1	1	1	1	2	1	1	1	2	2	1	1
Steel	HL1	MTO	I	CAP	3	1	3	2	3	1	1	2	1	1	3	2
Heating A	HL1	MTS	I	COM	2	1	1	2	1	2	2	1	2	2	2	2
Heating B	HL1	MTS	I	COM	2	1	1	2	1	2	2	1	2	2	2	2
Drill	HL1	MTS	I	CAP	1	1	1	2	2	3	1	2	3	2	1	1
Off-road A	HL1	MTO	I	COM	2	1	3	3	1	3	2	3	2	2	3	3
Off-road B	HL1	MTO	I	COM	2	1	3	2	1	3	2	2	2	2	2	1
Nokia 3310	HL1	ATO	I	REL	2	3	3	3	1	3	3	3	1	3	3	3
Nokia 1100	HL1	ATO	I	REL	2	2	2	2	1	2	3	2	1	2	2	2
Helkama	HL1	MTS	O	MOD	1	1	1	2	1	3	2	1	2	2	2	1
Marine A	HL1	MTO	I	COM	2	2	2	2	1	2	2	2	2	2	2	2
Marine B	HL1	MTO	I	COM	2	2	2	2	1	2	2	2	2	2	2	2
MaterialHandling	HL1	ETO	I	COM	1	2	2	2	1	2	2	2	1	2	2	2
ConsumerTech D	HL2	MTS	O	MOD	1	1	1	2	1	1	2	2	1	1	1	2
Nokia 1200	L	ATO	I	REL	2	1	1	1	1	1	3	1	1	1	1	1
Textile A	L	MTS	O	MKT	1	1	1	1	2	1	1	1	1	1	1	1
Textile B	L	MTS	O	MKT	1	1	1	1	2	1	1	1	1	1	1	1
Textile C	L	MTS	O	MKT	1	1	1	1	2	1	1	1	1	1	1	1
Textile D	L	MTS	O	MKT	1	1	1	1	2	1	1	1	1	1	1	1

Production:
Location
H-production in high-cost country only
L-production in low-cost country only
HL1-similar production in both high-cost and low-cost countries
HL2-different kinds of production in high-cost and low-cost countries
Type
MTS-make to stock
MTO-make to order
ATO-assemble to order
ETO-engineer to order
Supply chain structure (Gereffi et al., 2005)
MKT-market
REL-relational
CAP-captive
MOD-modular
COM combination of relational, captive, and modular
Formalization, Coupling & Specificity:
1 managerially negligible
2 managerially relevant
3 managerially crucial
Note: formalization is reverse-coded in the table: a higher value indicates *lower* formalization. This way all three variables are coded such that a higher value (i.e., low formalization, tight coupling, and high specificity) indicates higher interdependence.

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interdependencies between the final stage of production and the first-tier supplier base. The theoretical typology by Gereffi et al. (2005) categorizes supply chain governance as follows:

1. *Market.* These are arm's-length relationships with low switching costs. Despite low switching costs, these relationships are not necessary transitory, but can also be recurring.
2. *Modular.* Suppliers in modular supply chains make products to a customer's specifications. At the same time, suppliers are separate legal entities that assume full responsibility for competencies such as process technology. Suppliers also often seek to avoid specificity by using general-purpose technology, for example.
3. *Relational.* Relational governance consists of complex interactions between buyers and sellers. This often creates mutual dependence and high levels of specificity. Scholars have highlighted the role of spatial proximity in supporting relational structures, but trust and reputation can function in spatially dispersed networks as well.
4. *Captive.* Small suppliers are transactionally dependent on larger buyers. Suppliers face significant switching costs, hence the notion of *captive.* Buyers are the lead firms monitoring and controlling the relationships.
5. *Hierarchy.* This is essentially vertical integration where the dominant form of governance is managerial control.

4.1. Data collection

We collected data for each case through a combination of methods: (1) workshops with senior operations managers (between three and eight workshops per case, between 2 and 4 h per workshop); and (2) interviews (on average six interviews per case, one interviewee and one or two interviewers per interview, duration between 1 and 2 h). Both interviews and workshops were conducted in a semi-structured way in that the general and even some specific topics were decided up front, but discussions were allowed to take unplanned directions based on what may have unfolded as relevant. The people interviewed were often the same people who attended the workshops. The task of the researchers in the workshops was to facilitate discussions. The research process was partly iterative in that researchers often presented their research findings as a contribution to workshop discussion. When deemed necessary, the data collected in the interviews and workshops was supplemented and elaborated through email and telephone communication. The general approach to data collection is summarized in Table 4. Below, we illustrate the data collection process using one of the cases.

The analysis of *Case Off-road A* (an off-road utility vehicle) is based on data from both product and firm levels. The data were collected in six workshops and five in-depth interviews. The data were collected in two waves: (1) the first three workshops and three of the interviews were conducted between January 2011 and December 2011, (2) three other workshops and interviews were conducted between October 2012 and May 2013. Interviews lasted approximately 1.5 h. Two research-team members and three to five persons from the firm attended each workshop.

The overall data collection effort was both time consuming and intensive. Each firm contributed between 40 and 80 h of their time to provide us with sufficient data. Across the 35 cases, this means over two thousand hours of managerial effort. We spent a total of three to eight months with each firm.

5. Analysis

In each of the 35 cases, we identified through interviews the key factors underlying location decisions. This analysis was performed using a combination of within and cross-case analyses, as described by Eisenhardt (1989). In the within-case analyses, we sought to understand each location decision in its own right, and in the cross-case analyses, we sought to identify the recurring aspects and broader tendencies.

The cross-case analysis allowed us to map each case onto the general framework in Fig. 1. For each case, we used a three-category ordinal measure to assess the importance or prevalence of each of the three dimensions. We felt comfortable with a three-category measure to indicate whether the dimension was negligible (coded as “1”), relevant (“2”), or critical (“3”). For example, in *Case Timber*, production is characterized by high formalization and low specificity (general-purpose assets). Within production and toward the downstream value chain coupling is tight, but is loose within the upstream value chain and product development.

5.1. How coupling, formalization, and specificity relate empirically

As in factor analysis, the first question of theoretical interest is whether the three key dimensions identified a priori are a manifestation of some underlying factor such as *overall complexity*. Whereas the three concepts are empirically related in a theoretically predictable manner (formalization is associated with decoupling), these relationships are not strong, let alone one-to-one mappings. We conclude that each of the three dimensions adds its unique empirical contribution. But whether and how the three link to location decisions in particular still needs to be established. This is discussed below.

5.2. Production-Supply Dyad

Case Ponsse (the forest tractor) is a relatively complex ETO product. Low formalization makes managing supplier relationships complex, hence supply-chain governance is relational. The Production-Supply Dyad is also tightly coupled: Operating in an ETO environment requires intensive communication and joint problem solving with key suppliers. Finally, although specificity is not a critical factor, it is relevant enough to complicate long-term management of the production-supply relationship. The complexity of the Production-Supply Dyad has a strong influence on the production-location decision: Ponsse's entire final assembly as well as critical parts of Ponsse's supply network are located in Finland.

Case ConsumerTech D offers an informative contrast to *Case Ponsse.* Its buyer-supplier dyad is characterized by low specificity, loose coupling, and high formalization, giving management considerable freedom with regard to location decisions. Not surprisingly, the final assembly not only takes place in low-cost countries, but is also outsourced. As a more general observation, we find that final assembly is outsourced in five out of six cases where final assembly takes place only in a low-cost country. In all other production-geography configurations, in-house production dominates (see Table 2).

5.3. Production-Development Dyad

The Production-Development Dyad in the *ConsumerTech A* case is maximally complex: low formalization, tight coupling, and high specificity. The predictable response for managing such complexity is to co-locate development activities with production. Indeed, the product is assembled in Finland where the majority of

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Table 4
The general approach to data collection.

Phase	Activities
Initiation	**Research team**
	(1) submits to the case firm a project brochure describing the aims of the project
	(2) signs a non-disclosure agreement
	Case firm
	(3) submits to the research team product bill of material and product history
	(4) submits to the research team the relevant accounting information (product costs, transfer prices, etc.)
	(5) submits to the research team other requisite financials (e.g., income statement and balance sheet)
	Research team and case firm
	(6) organize the Kick-off Workshop
Analysis	**Research team**
	(1) conducts supplier cost structure analyses based on documentation and interviews with sourcing experts
	(2) conducts internal cost structure analyses based on documentation and interviews with accounting experts
	(3) conducts an analysis of transfer prices based on documentation and interviews with finance experts
	Research team and case firm
	(4) organize one or several Analysis Workshops
Conclusion	**Research team**
	(1) prepares a final report of the case
	(2) prepares the final report of all cases
	Case firm
	(3) reviews and approves the case description
	Research team and case firm
	(4) attend the Final Workshop

development efforts take place as well. The interdependence is so strong that in order for manufacturing to relocate, R&D must relocate as well. We return to this point in the discussion of policy implications.

Case Helkama (the bicycle) offers an interesting contrast case to *ConsumerTech A*: the Production-Development Dyad is simple in that it is characterized by negligible specificity, loose coupling, and high formalization. In light of these realities, there is no pressure to co-locate production and product development. Indeed, Helkama can flexibly change the final assembly site as frequently as once per year. In the recent past, the site of final assembly has been in Malaysia, Lithuania, and in Finland. Currently, a number of Helkama bicycles are assembled in Finland.

5.4. Production-Market Dyad

In considering the implications of the Production-Market Dyad for location decisions, coupling clearly emerges as the key factor. This is illustrated by the foodstuffs cases (*Chicken*, *Jam*, *Meat*, *TV Dinner*, *Candy*, *Bread*, *Toast*). Despite high formalization and low specificity, all these products are produced in Finland for a simple reason: Production and markets are tightly coupled. Two factors limit sale to local markets: Products are perishable and margins are low. In all the food industry cases, production is located in Finland and done in-house, demonstrating that simple products produced by comparatively simple production processes may well be produced in high-cost countries. Even if production of these products does not itself add much value, operating the production facilities provides employment and tax revenue, strengthening the economy.

All four *Case Textiles* offer an interesting contrast to the food-industry cases. Here the story is the more familiar one: The loose coupling of the Production-Market Dyad allows location decisions to be made independently of market considerations. This is further enabled by the high formalization and low specificity of the Production-Market Dyad. Not surprisingly, in all four *Textile* cases, production is located in a low-cost country and is also outsourced.

6. Discussion

In our analysis, we have sought to understand how coupling, formalization, and specificity play a part in location decisions. To this end, our goal has been to understand the pertinent issues one *decision* at a time, not one *factor* at a time as it is often done in the extant literature. The overarching theme that emerges from the analyses is that location decisions reflect some notion of *interdependence*. Although the basic idea is not new (Thompson, 1967), our analysis gives insight into such interdependencies and the implicit barriers to entry that they create for foreign competition.

Of the three factors examined, coupling is the most intuitive manifestation of interdependence, and may trump all other factors in the production-location decision. The food industry cases are a good example. According to the *Finnish National Board of Customs* and *Statistics Finland*, Finns spend more money on food (about $3300 per year per capita) than they do on insurance, electronics, and education combined. Nearly 80 percent of this consumption is produced domestically. The food supply chain (from production to retail) directly employs 300,000 people, representing 12% of total employment. Egg production may not compete with biotechnology or cloud computing in terms of cutting-edge innovation, but we must not underestimate the importance of the low-tech industries in any national economy. Globalization has done surprisingly little to change these basics. Not only is food production important for high-cost economies (practically all the value created stays within the home country, see Table 2), but strong coupling with the market means that future offshoring is unlikely.

High specificity means high interdependence. Importantly, specificity reminds us that even though a business relationship (e.g., buyer-supplier) can start out as arm's length, interdependence tends to develop over time. Indeed, transaction cost economics suggests that a key dynamic of transaction governance is *the fundamental transformation*: even if the initial conditions are competitive (i.e., multiple suppliers exist), over time the supply relationships become idiosyncratic and an individual supplier will become differentiated from the rest (Williamson, 1985). Such fundamental transformation in the exchange conditions is difficult to avoid: At least some co-specialization—and consequently specificity—will unavoidably develop over time. The two cardboard

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cases (*Cardboard A* and *Cardboard B*) provide good examples: Even though the Production-Supply dyad is highly formalized and coupling is negligible, specificity is rated *relevant* in both cases. This alone can explain why production takes place in Finland: That is where the firm needs access to raw materials, the majority of whom are in the forest products industry.

Finally, low formalization implies high interdependence. Ponsse (the forest tractor) is the best example of this. When all three dyads have low formalization, it is understandable that production will be collocated with suppliers and development activities. Insofar as suppliers and development activities are in Finland, so is production. More generally, certain forms of production are by their essence more formalized.

6.1. Generalizability

We have looked at 35 individual decisions, each of which is unique in the sense that it must be understood in its own proper context. Our analyses (summarized in Table 3) can, however, be used to make some theoretical generalizations and at least rudimentary qualitative counter-factual analysis. More rigorous quantitative counter-factual analysis is an important avenue for future research.

We observe that locating production—in our case, the final stage of production—in the high-cost country is always associated with at least one of the interdependence factors being at a high level. Which particular one, or ones, are critical depends on the context. Based on all our data and analyses, coupling seems to be the most significant source of interdependence, followed by specificity, then formalization. While we must refrain from drawing any statistical generalizations because the sample is non-random, this ordering makes substantive sense. In particular, we find the proposition that coupling is the most important source of interdependence in location decisions plausible. Specifically, if production is tightly coupled with development, relocating one implies relocating the other. In contrast, low formalization of the Production-Development Dyad may make it *easier* to manage the relationship if the two activities are geographically collocated, but coordination can succeed even without collocation as well.

We also observe that the common denominator in the cases where production takes place only in the low-cost country is high formalization combined with low specificity. This is not surprising: It is specifically the routinized, generic forms of production that become candidates for both outsourcing and offshoring. However, looks can be deceiving in that routinization may or may not be the *reason* for locating production in the low-cost country. In the case of *Nokia 1200*, production is highly formalized, but this is not the reason production is located in a low-cost country. The reason is the tight coupling with the market. Consider in contrast the four textile cases examined. Textile production is located in low-cost countries primarily for cost reasons, thus taking advantage from high formalization and decoupling. In sum, we must always carefully analyze whether high formalization and decoupling are the *reasons* for locating manufacturing in a low-cost country, or simply ancillary factors.

Finally, supply chain governance follows predictable patterns in the sample as well. When production is in a high-cost country, the governance mode is non-market (Gray et al., 2017). When production is in low-cost countries, the predominant mode is the market. This is consistent with predictions from transaction cost economics: When specificity and coupling are low, the most effective form of governance in the buyer-supplier link is the market.

6.2. Implications for policy

Both in terms of manufacturing and of business location decisions more generally, a key policy objective from the point of view of a nation state is to nurture internationally immobile and hard-to-replicate factors of production that sustainably can earn high returns—both in terms of wages and profits—in international markets. Our results suggest that insofar as location decisions are concerned, thinking in terms of industries may be misguided. Industry may be a salient category to the policy maker, but the key to understanding location decisions, in light of our data, hinges on understanding interdependence that arises from formalization, coupling, and specificity. These can offer new and actionable categories for policy examinations.

Let us start with the extreme case of independence: high formalization, low specificity, and loose coupling. In such contexts, the economically attractive location for production will emphasize cost. Predictably, this is what we observed in our data.

Consider in contrast the case of extreme interdependence: low formalization, high specificity, and tight coupling. Ponsse's forest tractor provides an excellent example. Such contexts bring to mind the word *ecosystem*: Ponsse's value chain is essentially a community of highly interdependent economic actors whose fates are fundamentally linked to one another. It is specifically this kind of ecosystem that houses the immobile, hard-to-replicate essence of production central to national economies. If the systems of production in these ecosystems exhibit high specificity in particular, it means that the failure of the ecosystem would immediately threaten productivity. By definition, high specificity means the value of an asset in its primary use is much higher than in the secondary use. If Ponsse were to fail, not only its own productive resources but also those of its key suppliers would be shifted to their second-best use, which would lower productivity. In the case of Ponsse, specificity is *relevant* or *critical* in all the three dyads. In contrast, value chains where assets are not specialized are not as vulnerable, because having to downgrade an asset to its second-best use would not threaten productivity as much.

Important policy insight can be found by encouraging policy-makers to replace conventional industry thinking with the new ecosystem thinking. Here, it is crucial to understand that an ecosystem is not just any agglomeration of economic actors. Just like a biological ecosystem, an economic ecosystem is characterized by networks of interactions and interdependencies. In our analysis, we have mapped out what these key interdependencies are. Further, these interdependencies lie at the very foundation of the immobile, hard-to-replicate factors that earn high returns. We are convinced that understanding ecosystems paves the way toward gaining a better understanding of economic growth at the country level.

In thinking of long-term economic policy, and industrial policy in particular, our recommendation is this: when policy-makers think what kind of production is desirable and feasible to keep in a high-cost country, they should focus on contexts where meaningful ecosystems (of high interdependencies) can be identified. In particular, the degree to which economic actors in these ecosystems are tightly coupled is crucial to understand, because coupling is the most fundamental form of interdependence. If in addition the degree of specificity in the ecosystem is high, failure of the ecosystems presents a considerable threat.

7. Conclusion

John Zysman, one of the authors of *Manufacturing Matters* (Cohen and Zysman, 1987), the classic treatment of manufacturing policy, remarked in an industry seminar (Helsinki, August 29, 2014)

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that perhaps policy-makers should rethink their problem categories. But what exactly could constitute the new categories by which we should seek to make sense of manufacturing policy? When it comes to questions of strategy and policy surrounding location decisions, perhaps using industries (however defined), broader clusters (manufacturing vs. service), degree of value added, even size (SMEs vs. large companies) to create categories may be misguided. Our results suggest that as far as policy implications are concerned, conventional categories may be meaningless in helping us understand location decisions.

Cohen and Zysman (1987) further argued that manufacturing in modern economies is not disappearing, it is simply seeking new forms. But what are these new forms? We may have at least a partial answer: In our analysis of the 35 location decisions, the key theme that repeated itself throughout the cases was the notion of interdependence of activities. As a general finding, this is hardly surprising, but the detailed understanding of how formalization, specificity, and coupling link to location decisions has the potential to both inform firm-level strategies and to at least introduce new vocabulary into discussions of economic policy.

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