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ABSTRACT

Absorptive capacity is frequently highlighted as a key determinant of knowledge transfer within MNEs. But how individual behaviour translates to absorptive capacity at the subsidiary level, and exactly how this is contingent on subsidiaries' social context, remains under-addressed. This not only limits our understanding of the causal linkage between individual and organizational level absorptive capacity, it also hampers further research on potentially relevant managerial and organizational antecedents, and limits the implications we can draw for practitioners in the field seeking to increase their organization's capacity to put new knowledge to use. To address this shortcoming we conduct an in-depth comparative case study of a headquarters-initiated knowledge transfer initiative at two subsidiaries of the same MNE. The findings demonstrate that social interaction is a key requirement for subsidiary absorptive capacity as it enables employees to participate in the transformation of new knowledge to the local context. Second, the findings illustrate how organizational conditions at the subsidiary level can impact subsidiary absorptive capacity by enabling or constraining local interaction patterns. These insights contribute to the absorptive capacity literature by demonstrating the scale and scope of social interaction as the key link between individual- and organizational-level absorptive capacity.

Key words: absorptive capacity; social interaction; subsidiary learning

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INTRODUCTION

The ability to generate and transfer knowledge is frequently highlighted as one of the key capabilities of the multinational enterprise (MNE) (e.g. Kogut and Zander, 1993; Grant, 1996). It should therefore come as no surprise that intra-MNE knowledge transfer has emerged as one of the main research topics within research on MNEs (Foss and Pedersen, 2004; Pisani, 2009). The dominant conceptualization of intra-MNE knowledge transfer is the sender-receiver perspective (Carlile, 2004; Noorderhaven and Harzing, 2009). In this view, learning is typically understood as the transfer of relatively predefined kinds of knowledge from the sending unit to the receiving unit, in a manner that is largely detached from the wider social contexts that lead to firm survival and effective performance. The sender-receiver perspective has generated valuable research on for instance the relation between sender and receiver and the richness of the transfer channel (e.g. Gupta and Govindarajan, 2000; Almeida and Phene, 2004; Schulz, 2003), but at the same time the sender receiver perspective has also diverted attention from the micro-level origins of subsidiary learning. As a result we still know little about, for instance, the organizational antecedents that enable or constrain subsidiary learning and how subsidiary learning relates to the behaviour of individual actors (Foss and Pedersen, 2004).

Making better use of the absorptive capacity construct—the combination of a receiving unit's ability and motivation to recognize, assimilate and apply new knowledge (Cohen and Levinthal, 1990; Minbaeva *et al.*, 2003)—would help address the inattentiveness to the foundations of subsidiary learning. In fact, absorptive capacity of the receiving unit is already frequently highlighted as a key determinant of knowledge transfer

within MNEs (e.g. Gupta and Govindarajan, 2000; Minbaeva *et al*., 2003) and subsidiaries' innovativeness and profitability (e.g. Tsai, 2001; Phene and Almeida, 2008). However, the explanatory power of absorptive capacity itself is limited by insufficient attention to the link between the individual and organizational level. What remains particularly unclear is how individual behaviour translates to absorptive capacity of the organizational unit. As a result, our understanding of *how* new knowledge is assimilated internally and the role of individual actors and organizational conditions remains incomplete.

This should frustrate both management scholars and practitioners. The notion of absorptive capacity has its origins in the literature on human cognition (Cohen and Levinthal, 1989; 1990) but—like many multi-level theories (Felin and Foss, 2005)—it is applied at the organizational level almost by analogy. This not only limits our understanding of the direct causal linkage between individual and organizational level absorptive capacity, but also hampers our understanding of (and research on) managerial and organizational antecedents. To practitioners, the absence of a clear micro-macro level understanding of absorptive capacity is equally disconcerting. As Abell, Felin and Foss (2008) argue, while research often halts at identifying macro-macro (i.e. organizational) level correlations, managerial intervention almost always involves the micro-level of individual employees. A general understanding of the micro-macro dynamics of absorptive capacity is therefore crucial in facilitating managerial action in knowledge transfer and learning.

To better understand the micro-level origins of absorptive capacity at the subsidiary level, we conduct an in-depth comparative case study of two subsidiaries in the context of a centrally initiated knowledge transfer within the same MNE. The two subsidiaries are very similar, yet demonstrate differences in their capability to learn and to sustain the transfer initiative. While the German subsidiary displays extensive learning across different

organizational levels, the British subsidiary displays only limited learning and the transfer initiative is not sustained locally.

We find that the difference in the subsidiaries' capacity to absorb knowledge is strongly linked to both the scale and scope of social interaction. In particular, we illustrate that social interaction is crucial in enabling individual actors to participate in the transformation of knowledge to the local context. As such, social interaction is not merely facilitative of organizational-level absorptive capacity (cf. Zahra and George, 2002; Todorova and Durisin, 2007) but a prerequisite to it: It performs the key role of linking individual absorptive capacity to that of the organization. The findings also suggest how the ability and willingness of individuals to participate in knowledge transformation relates to organizational conditions, such as incentive systems, leadership style and structural demarcations. Such conditions impact subsidiary success in the integration of new knowledge, and whether subsidiary learning efforts are sustained locally, by facilitating or constraining social interaction, and hence actors' involvement in the transformation of new knowledge.

The remainder of this paper is organized as follows: In the following section we discuss the literature on knowledge transfer and absorptive capacity. We argue that adopting a less restrictive view of absorptive capacity beyond knowledge acquisition has the potential to enrich the MNE knowledge transfer literature, but also note that the absorptive capacity literature itself is largely inattentive to micro-macro dynamics. In section 3 we present the research methodology and introduce our research sites. The empirical findings—differences in learning patterns within the same MNE—are presented in section 4, and in section 5 we discuss the differences in social interaction patterns which explain the differences in learning outcomes at the two subsidiaries. We subsequently highlight the importance of organizational conditions in understanding differences in the

subsidiaries' absorptive capacity and motivational disposition, which is then followed by the development of a set of propositions. In section 6 we discuss the conclusions and highlight the contribution of the study to the literature on absorptive capacity and MNE knowledge processes.

SUBSIDIARY LEARNING AND ABSORPTIVE CAPACITY

Knowledge processes—or the creation, adoption and diffusion of knowledge—are of great strategic importance to the multinational enterprise (MNE) as they are critical to the MNE's ability to build and sustain competitive advantage (e.g. Ghoshal and Bartlett, 1988; Kogut and Zander, 1993; McEvily and Chakravarthy, 2002). The dominant conceptualization of knowledge transfer within MNEs, which Noorderhaven and Harzing (2009) term the sender-receiver model, is that of knowledge transfer as the flow of knowledge between sending and receiving unit (e.g. Szulanski, 1996; Gupta and Govindarajan, 2000). Derived from information and communication theory (Carlile, 2004), the sender-receiver perspective emphasises that knowledge flows are promoted or impeded depending on characteristics of the sending unit, the transmission channel, the transfer message, the receiving unit, and the transmission context (Szulanski, 2000).

Correspondingly, this conceptualization of MNE knowledge transfer has particularly furthered our understanding of how intra-MNE knowledge flows differ depending on characteristics of the sending and receiving unit (e.g. Gupta and Govindarajan, 2000; Phene and Almeida, 2008; Szulanski, 1996), the knowledge to be transferred (e.g. Schulz, 2003; Dhanaraj et al., 2004), the richness of the transfer channel (e.g. Almeida and Phene, 2004; Björkman et al, 2004; Hansen and Løvås, 2004), and the degree of similarity between transfer contexts (e.g. Cui et al., 2006; Bhagat et al., 2002;

Doz and Santos, 1997; Kedia and Bhagat, 1998; Yang, Mudambi and Meyer, 2008). However, adopting the sender-receiver model as the dominant metaphor of MNE knowledge transfer has also limited MNE knowledge research from focusing on the sub-organizational conditions that affect MNE learning. This limits our understanding of MNE knowledge transfer—and subsidiary learning in particular—in at least three respects.

First, there is still little understanding of the role of individual actors in MNE knowledge adoption and integration, in particular how their social interaction translates into subsidiary learning. As Foss and Pedersen (2004) note, MNE learning research frequently makes use of aggregate concepts at the MNE level such as 'motivational disposition' and 'combinative capabilities' which commonly lack a micro-foundation. As a result, it is often "hard to link knowledge processes, such as knowledge transfer, to [individual] behavior" (Foss and Pedersen, 2004: 343), which hampers both theory development and the formulation of managerial implications.

In addition, although attention to social interaction is not entirely absent in MNE knowledge research (e.g. Björkman, Barner-Rasmussen and Li, 2004; Schulz, 2003; Subramaniam and Venatraman, 2001; Persson, 2006; Noorderhaven and Harzing, 2009), its exploration has mainly been in the inter-firm context. Instead, there is much less work that looks at the role of social interaction at the intra-organizational level and as a result, little is still known about the full extent to which knowledge transfer and adoption is contingent on subsidiaries' social context. However, studies that *do* focus on social interaction and MNE knowledge transfer show considerable promise. For instance, Björkman et al. (2004) find that various socialization mechanisms positively impact subsidiary knowledge outflows. Similarly Noorderhaven and Harzing (2009), who test competing arguments from the sender-receiver perspective and social learning theory, find that the intensity of social

interaction between subsidiary and MNE is positively related to intra-MNE knowledge sharing.

Finally, there still is little theorizing or empirical exploration in MNE knowledge research of the changes knowledge inflows and the receiving context undergo when transferred knowledge is integrated (Becker-Ritterspach 2006; Noorderhaven and Harzing, 2009). Exceptions aside, learning at the subsidiary level is typically captured in terms of transfer outcomes, such as patent citations (Ahuja and Katila, 2001; Almeida and Phene, 2004; Yamin and Otto, 2004), product development (Tsai, 2001; Hansen, 1999), or the presence of predefined kinds of knowledge (Gupta and Govindarajan, 2000; Hansen, 2002; Schulz, 2003). The problem here is that focusing on transfer outcomes in such a way tells us little about the underlying organizational conditions and processes that produce such outcomes. Thus, *how* received knowledge is translated, interpreted, and integrated, or the *transformative* aspect of knowledge transfer (Becker-Ritterspach, 2006), is often ignored.

The argument developed below is that these shortcomings can be addressed by both more fully embracing the concept of absorptive capacity (Cohen and Levinthal, 1989; 1990) in understanding subsidiary learning, and extending the concept of absorptive capacity to better understand how behaviour at the micro-level of individual actors translates into differences in learning outcomes at the subsidiary level. Subsidiaries' absorptive capacity is already widely recognized as one of the key factors facilitating MNE knowledge transfer (e.g. Gupta and Govindarajan, 2000; Minbaeva et al., 2003). However, in line with the sender-receiver metaphor the MNE knowledge transfer literature primarily considers absorptive capacity in relation to knowledge acquisition (e.g. Gupta and Govindarajan, 2000). W*hich* and *how* local conditions facilitate the subsequent transformation and successful application of new knowledge is rarely looked into. Hence, the MNE literature tends to make only partial use of the notion of absorptive capacity.

This, we feel, is a missed opportunity. The concept of absorptive capacity is well suited to enhancing our understanding of subsidiary learning. In particular, both the construct's attention to local conditions and the transformative nature of knowledge may further our understanding of how local conditions enable or constrain subsidiary learning outcomes. However, as we explain below we also claim that the notion of absorptive capacity needs to be extended. In particular, what remains unexplained is how the actions of individual actors translate into absorptive capacity at the organizational level and exactly how this is contingent on the social context.

Absorptive capacity

Despite differences in emphasis and more recent refinements (e.g. Zahra and George, 2002; Todorova and Durisin, 2007), the concept of absorptive capacity essentially rests on three components that go back to Cohen and Levinthal's (1990) work. First there is the element of recognizing and acquiring new knowledge. The second element is the processing of new knowledge, which is labelled as assimilation and/or transformation. And third, there is the element of putting knowledge into effective use, often labelled as application (Cohen and Levinthal, 1990; Lane, Salk and Lyles, 2001; Todorova and Durisin, 2007), utilization (Lane et al., 2006; Minbaeva et al., 2003), or exploitation (Lane et al., 2006; Zahra and George, 2002). Based on these elements Lane *et al*. (2006) define absorptive capacity as "a firm's ability to utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning" (2006: 856).

Organizational units' absorptive capacity first of all depends on prior knowledge (Cohen and Levinthal, 1990): Related knowledge facilitates the effective communication of new knowledge, while diversity of knowledge stimulates innovative application of new knowledge. Second, organizational units' ability to absorb new knowledge is affected by the interface between knowledge source and receiving unit. Here, similarity between sending and receiving unit has been argued to facilitate the effective communication of new ideas (Gupta and Govindarajan, 2000), while boundary spanners play the important role of translating and disseminating new information internally (Cohen and Levinthal, 1990).

In addition to prior knowledge and the degree of similarity between sending and receiving unit however, absorptive capacity is strongly linked to local conditions (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen, Van den Bosch, and Volberda, 2005). This is because the ability to adopt new knowledge and practices and to put that knowledge to practical use depends not only on knowledge acquisition, but also on how transferred knowledge and practices are assimilated and/or transformed, and subsequently implemented (Cohen and Levinthal, 1990; Zahra and George, 2002; Todorova and Durisin, 2007). Here, both social interaction and organizational processes are argued to play a crucial role. Social interaction has been repeatedly linked with the ease with which the different components of absorptive capacity take place (e.g. Zahra and George, 2002; Todorova and Durisin, 2007). And while units' absorptive capacity is a function of local actors' individual absorptive capacity (Cohen and Levinthal, 1990), it is organizational processes that "enable the organization to share, communicate, and transfer individual-level learning to the organizational level" (Lane et al., 2006: 846).

The micro-macro link of absorptive capacity

The absorptive capacity concept recognizes both the transformative nature of knowledge—the idea that new and old knowledge combine into something new—and that both the efficiency and effectiveness with which organizational units absorb new knowledge is intimately linked to local conditions (Cohen and Levinthal, 1990; Lane et al., 2006). Embracing the notion of absorptive capacity in understanding subsidiary learning may therefore help address the inattentiveness in IB research to how local conditions enable or constrain learning at the subsidiary level, as well as the transformative aspect of learning. (See for instance Minbaeva et al. (2003) for an illustrative example of how HRM practices impact subsidiaries' absorptive capacity and the level of knowledge transfer). In addition, the notion of absorptive capacity is rooted in work on individual learning and cognition (Cohen and Levinthal, 1990: 129-131). Applied to the context of MNEs, the notion of absorptive capacity therefore provides useful leads on how subsidiary-level learning outcomes relate to sub-organizational processes and conditions, and to the behaviour of organizational members.

However, two related issues also limit the explanatory potential of absorptive capacity in understanding subsidiary learning, namely inattentiveness in empirical studies to the role of social interaction, and insufficient theoretical discussion of how individual behaviour translates to absorptive capacity of the organizational unit. Empirical research on absorptive capacity has traditionally adopted a relatively narrow view of absorptive capacity as relating to firms' prior knowledge base—often with R&D intensity as a proxy—in which the organizational processes leading to knowledge acquisition, assimilation and application are often overlooked (Lane *et al*., 2006). As a result, while the *analytical* components of absorptive capacity have now been empirically identified (Jansen

et al., 2005), our understanding of how new knowledge is assimilated and the role that individual actors assume in this process remains limited.

This relative inattentiveness to social interaction in empirical research is reflected in theoretical discussions on what constitutes absorptive capacity. The roots of absorptive capacity are in work on human cognition (e.g. Bower and Hilgard, 1981; Lindsay and Norman 1977) and, hence, traditionally there has been much attention to the role of individual capabilities. But how individual behaviour translates to absorptive capacity of the organizational unit is not sufficiently discussed: Although social interaction is recognized as linking individual behaviour to units' absorptive capacity (Cohen and Levinthal, 1990), in most discussions the relationship between social interaction and absorptive capacity is often sidelined as one antecedent among others or merely inferred from the notion that absorptive capacity comprises a set of organizational routines (e.g. Zahra and George, 2002; Todorova and Durisin, 2007). Instead, whether and how differences in social interaction translate to organizational-level differences in learning outcomes remains under-addressed, and how and why social interaction patterns may differ is not sufficiently specified. The inattentiveness to the role of social interaction implies that we still have little knowledge of the micro-level origins of absorptive capacity at the subsidiary level. Therefore, we aim to explore how and why actors' interactions shape absorptive capacity at the organizational level to produce different learning outcomes.

METHODOLOGY

We strive to achieve this objective through a comparative case study of a centrally initiated introduction of continuous improvement principles at two subsidiaries of a Dutch MNE in the chemical industry. Dutch Chem (a pseudonym)—a Fortune Global 500 company—

employs 62,000 people globally and operates in more than 80 countries. We selected two subsidiaries that differ markedly in terms of learning outcomes, although they are very similar in terms of characteristics that are predicted by knowledge transfer and absorptive capacity literature to affect learning outcomes. The two subsidiaries, which are located in the UK and Germany and which both belong to the firm's paints division, displayed similar characteristics in terms of transfer content, transfer channel and key characteristics of the sending and receiving unit: Both subsidiaries received the same new knowledge, through the same transfer channels, from the same sending unit at about the same time. In addition, both subsidiaries were similar in size, operated in the same field of business and had a comparable knowledge base and motivational disposition, as indicated by their branch of industry, skill levels, employment seniority and the imminent threat of plant closure. Yet, as illustrated in the following sections, the two subsidiaries also differed markedly in terms of learning outcomes; i.e., the extent to which the transferred continuous improvement principles were transformed and sustained locally. In particular, while the UK subsidiary showed only limited transformation and application of the transfer initiative, the German subsidiary transformed and applied the continuous improvement more extensively.

Table 1 and 2 about here

The case studies consisted of both field research—carried out between 2006 and 2007—and desk research. Field research consisted of visits to headquarters and two day-long visits at both subsidiaries, followed by a week-long participant observation at each subsidiary by a member of the research team. During the day-long visits at both subsidiaries, a total of 13

semi-structured formal interviews were conducted with interviewees ranging from headquarter management to subsidiary managers. Interviews lasted between 30 minutes and two hours. The week-long participant-observation at each site allowed for an additional 33 semi-structured interviews, lasting between 15 and 45 minutes, with operators, team leaders, shift managers and plant managers, and for the collection of company documentary data such as operation manuals and regulations. (See Table 2 for a list of informants.) Information was collected from respondents on the strategic and operational goals underlying the continuous improvement initiative, the resources made available by headquarters, the manner in which the new knowledge was implemented, the extent to which the subsidiaries changed their practices and the extent to which various organizational members were involved in this process.

Empirical definitions

Drawing on the three core elements of absorptive capacity, we see subsidiary learning as based on organizational members' ability and motivation to acquire, transform and practically utilize new knowledge (Minbaeva et al. 2003). In addition, similar to Szulanski's (1996) concept of 'retentive capacity' we see the success of learning expressed in the transformation and sustained use of new knowledge. Thus, we consider learning outcome as 'extensive' when acquired knowledge is transformed, applied and sustained into new or changed practice. Conversely, we consider learning as 'limited' when acquired knowledge is not transformed, applied and sustained into new or changed practice.

Guiding the case analyses is our interest in the link between the success with which the transferred continuous improvement initiatives were transformed, applied and sustained, and the social interaction patterns at both subsidiaries. We operationalized 'transformation' as a change in knowledge content resulting from local reinterpretations of

the continuous improvement principles. Instead, 'application' was deemed to have taken place if the introduction of continuous improvement practices resulted in the development of new practices, or in changes in old practices. Finally, we took social interaction as a function of both the actors involved in learning activities and the relations between these actors. Thus, important questions here are: who participates in learning activities and in what role (Zahra and George, 2002), the level of social cohesion among actors (Reagans and McEvily, 2003), and the strength and the degree of continuity or persistence of social interaction patterns (e.g. Reagans and McEvily, 2003; Szulanski, 1996).

Data analysis

The data analysis of this project followed Eisenhardt (1989, Eisenhardt and Graebner, 2007) in starting with within-case analysis followed by cross-case analysis. According to Eisenhardt (1989: 540) "[w]ithin-case analysis typically involves detailed case study write-ups for each site". Such detailed and descriptive 'write-ups' for the two cases were also the first step of this study. The write-ups were mainly structured along the analytical dimensions defined by our theoretical discussion, that is, the core dimensions of absorptive capacity (acquisition, transformation and application) and social interaction patterns (social cohesion, strength and degree). However, before these write-ups were made, field notes, transcribed interviews and documents were thoroughly read and manually coded according to analytical categories derived from the theoretical discussion (see the Appendix for an illustrative list of codes and statements denoting how these are related). In this process interviews were decomposed and chunks of coded interview-sections grouped according to our analytical dimensions. The reliability of the findings was further enhanced by making explicit the procedures that were followed for data collection. For example, we recorded interviews, and collected participants' feedback on transcripts and executive summaries. To

ensure reliability of the data, several data quality checks were performed. For instance, interview data from a particular work group were checked both against responses from another group and against quantitative data on production levels. Similarly, subsidiary and headquarter members' accounts were cross-checked against each other to validate case findings. Recurring themes and categories were identified through cyclical reading and rereading of both the interview transcripts and the written accounts of the field studies, and coding checks during the coding process ensured agreement among members of the research team.

The second step consisted of the cross-case comparison. The main goal of this analytical step was to identify pattern similarities and differences across cases (Ragin, 1987). To make this process possible, the initial detailed write-ups were further reduced and condensed into shorter case profiles and tables (see Miles and Huberman, 1994). Following the 'pattern matching logic' (Ragin, 1987; Pauwels and Matthyssens, 2004), the final analytical step of this study involved investigating and exploring whether or not the differences in subsidiary learning could be attributed to associations between the analytical dimension of social interaction. This process was supported by extensive efforts of data display as suggested by Miles and Huberman (1994) (see also the tables in the empirical findings section below). In addition to detecting matches/contradictions based on comparisons between theory and data, an effort was made to specify associations that were deliberately not explicated in the theoretical framework. Contradictions, matches and newly emerging causalities were then fed into propositions presented in the discussion of this work (Eisenhardt, 1989). This led for example to the emergence and identification of those organisational conditions (leadership styles, structural demarcations and incentive systems) that were associated to different patterns of social interaction in our cases.

EMPIRICAL FINDINGS

In response to increased competition, in 2003 the European paints division of Dutch Chem initiated a continuous improvement programme labelled Star Trek. At the heart of the initiative stood the effort to improve operational performance of Dutch Chem's production sites. The required operational improvements included service level to customers, quality, cost per litre, stock levels, and health, safety and environmental issues. The Star Trek initiative was driven by headquarters and involved the same approach at all sites. All sites were required to work with a consultancy group that was strongly result driven focussing on improved operational performance through Pareto-analysis. This was combined with the transfer of new knowledge on continuous improvement principles from headquarters to the subsidiaries through extensive documentation. The documentation suggested a road map, and a range of systems (such as Kaizen and Six Sigma) and tools (such as 5S and lean manufacturing) that the sites could use to realize continuous improvement. The sites had considerable freedom to select the tools and systems, but were encouraged to take a participative approach in the realization of continuous improvement. Yet, as indicated earlier, despite many similarities in terms of characteristics related to absorptive capacity—such as age, size, knowledge levels and motivation—the two subsidiaries differed considerably in local applications of the acquired transfer knowledge and learning outcome (see Table 3 for an overview). Below we discuss for each subsidiary how the transfer knowledge was acquired, transformed and applied, the interaction patterns between employees involved in the transformation of the transfer knowledge, and the organizational conditions that enabled and constrained local interaction patterns.

Table 3 about here

Learning at German Sub

Knowledge absorption at German Sub

At the start of the Star Trek initiative German Sub was asked to reduce its production costs by half. Although this came as a surprise to the German management, the looming closure of the site proved a strong motivation to implement the Star Trek initiative. Star Trek at German Sub started with the involvement of an external consultancy firm. However, while the involvement of the consultancy firm was mandatory in the initiation stage, German Sub's management team decided to end the consultancy firm's involvement in the implementation stage of Star Trek. The German management team was initially "deeply impressed" by the results of the consultancy firm, but their enthusiasm faded as the production targets set by the consultancy firm proved unrealistic and the solutions offered proved to lack "sustainability [as] we went from one project to another" (plant director).

While German Sub continued to track the improvement of key performance indicators singled out by the Star Trek initiative, the main focus shifted to "people's behaviour and in creating a culture environment" that would lead to sustainable improvement behaviour to enhance such indicators (plant director).

The German subsidiary not only became selective in taking on the tools and systems suggested by Star Trek as it had to be decided "what kinds of components to take from it" (factory manager), but also engaged in extensive reinterpretation and reformulation of the original transfer content, which involved a cascade of deliberate translation of the original initiative. This included the "very deliberate decision not to sell

it under the Star Trek label" as "you have to get people's attention and you cannot get their attention with something they don't grasp or associate with" (factory manager).

The transformation and application of the Star Trek principles were expressed, first of all, in a change of wording of the original initiative and its transformation into a local vision for different organizational levels. Management first translated Star Trek into the strategic vision that "Cologne is a leading production site for paint" and adopted as the guiding slogan "Cologne: Impossible is nothing". At the level of operators, the overall vision played less of a role. Here, the Star Trek vision transformed into the guiding slogan "We Cologneians hand in hand", showing the image of the famous dome of Cologne. Most importantly, a so-called "Production role model Cologne", also called "the guidelines", were defined for both managers and workers as a behavioural standard. "The guidelines are something you can fall back on; this is something the subordinate and the superior can refer to in any kind of discussion" (factory manager).

These behavioural guidelines, in turn, were instrumental in implementing continuous improvement. The subsidiary's improvement practices moved from a formal suggestion scheme, which was hardly used owing to its "bureaucratic and cumbersome nature" (operator), to sustained continuous improvement practices on a day-to-day basis manifesting in "an order for the workshop" (group advisor). Countless examples of such continuous improvement practices were found during the research stay. Examples included changed filling processes for acticides, eye shower installations, piping to reduce yeast and the development of a local system to track the service level ("Manko tracking"). Not only did the different improvements outlast the end of the Star Trek initiative, but the implementation of continuous improvement principles proved sustainable even after the initiative had died down at corporate headquarters. In summary, the German subsidiary not only engaged in an extensive reinterpretation of the Star Trek initiative (transformation)

but was also able to apply this transferred and reinterpreted knowledge in the form of changed and sustained improvement practices at the site.

Social interaction at German Sub

The extensive transformation and application of Star Trek principles at the German subsidiary crucially rested on the participation of a wide range of internal actors, and strong cross-functional and –hierarchical integration and interaction.

At German Sub, *participating actors* were not only the management team that was involved in translating the Star Trek initiative, but also actors from across the hierarchical range. While top management mainly took on the role of acquirers and vision transformers of the headquarters initiative, middle management and, in particular, first line supervisors played a key role in transforming the vision into behavioural guidelines and day-to-day improvements. Middle managers and the supervisors supported the vision and the participative management approach from the top and were, at the same time, highly responsive to the operators' improvement suggestions from the bottom. Operators, in turn, were asked to participate in transforming the vision into behavioural guidelines and came up with most of the continuous improvement suggestions. It was recognized by all management layers that the operators had to be listened to as they "know three times more than the stupid manager knows" (factory manager). In the words of the group advisor, when it comes to "machine knowledge and understanding the problems, there the man in the line knows best and one has to appreciate that". This appreciation of operator participation was also reflected in the perception where improvements originated from:

> "A bit comes from the leader-level in filling and in production, but for the most part it comes from the people working on the machines who work with them day-in day-

out with them and say: ‘Listen, I have a problem here can’t we do this or that’.” (factory manager).

Finally, the local work council was an instrumental actor in the implementation of new practices. On the one hand, it secured the workers’ interest in the process. On the other hand, it helped management to implement the Star Trek initiative as it secured the support of operators in the process. In this context the chair of the works council commented on their involvement as follows: “We discuss this among ourselves and then we approach the management with our suggestions. Of course they are often not 100% identical and so we try to find a compromise”.

The transformation and application of the continuous improvement principles rested above all on a strong *social cohesion* at the German site, which facilitated cross-hierarchical and cross-functional communication. This cohesion was present in hierarchical terms, from top management down to the group of operators, but also between the works council and management. For example, the plant manager related closely to his middle management team as he had handpicked its members and trusted them. He also related closely to supervisors and operators as he had started his work career as an apprentice on the shop floor. Similarly, middle management and supervisors felt little professional distance to each other and to operators on the shop floor owing to their own technical or vocational training and careers.

By the same token, operators, supervisors and maintenance staff worked in close physical proximity and under the same managerial (production) authority which created social cohesion among the different occupational groups. While the low hierarchical distance facilitated the implementation of improvements by speeding up decision making, the low functional distance allowed fast informal pooling of different competences

(maintenance and production know-how) to improve processes. Moreover, there were also few demarcations between the members of different shifts as personnel shifted back and forth on a continuous basis. Finally, the relationship between management and the work council, described by management as a constructive relationship "of give and take" (factory manager), added to social cohesion and to an increase of mutual trust between management and labour.

The *social interaction* related to improvement activity was not spatially and temporally confined, but became institutionalized across functions and hierarchical levels at German Sub. After the failure to sustain the improvement projects initiated by the consultancy firm, the focus shifted to realizing a permanent improvement culture or practice. At the time of research, such a continuous improvement culture had materialized which manifested in strong cross-functional and -hierarchical face-to-face interaction as a matter of daily work. For example, when operators faced a problem in the production process, they would "simply walk into the production supervisors' office" (operator). If the problem or suggestion did not require much of an investment, the supervisor would directly call or walk over to his maintenance colleague, who would dispatch his maintenance craftsmen to take a look at the process. These frequent day-to-day interactions were enabled both by low hierarchical and functional demarcations as well as low socio-professional distance and the close spatial proximity of different functional areas. In summary, the transformation and sustained application of Star trek principles at German Sub was enabled by the participation of a wide range of strongly integrated actors that interacted cross-hierarchically and cross-functionally on a day-to-day basis.

Organizational conditions at German Sub

The comprehensive social interaction pattern at German Sub was facilitated by organizational conditions that enabled and encouraged the participation of employees in transforming the Star Trek principles. These conditions included a participatory leadership style, limited structural demarcations and a changed incentive system.

First, the site manager of the German subsidiary was a proponent of participatory and *people-oriented leadership.* He had also replaced middle managers who in his view stalled a participative leadership approach. Referring to one of the replaced managers he stated:

> "We had a leader, a nice guy, an older guy, he is still there, but a new role, he will retire next year, but his problem was, when he was leading the improvement process, when something failed, which will happen during the journey, he was telling people: If you ever do that again, you are fired... So what happened that the people didn't try out anything anymore, they didn't come back with ideas any more".

The people-oriented leadership philosophy also led to parting with the external consultancy as "[the consultancy] did not care about people" (plant director). A vital part of the leadership style consisted of open communication. It was openly communicated that Star Trek and the improvements that potentially resulted from it would be connected to job losses. At the same time, redundancies, unlike what Star Trek documents suggested, were seen as a last resort. For instance, the plan director stated in this context:

> "If you read his strategy paper or the road map, I am not sure in which paper it stands, it says that the improvements mainly have to come from laying off people

and I think he maybe means something different, but that's what is written in there and I don't agree".

However, if redundancies could not be avoided, emphasis was placed on preparing people into new jobs outside the firm. This, in turn, secured trust, which increased social cohesion and the willingness within the workforce to further participate in improvement processes. As one interviewee puts it: "The whole thing [...] builds on trust, no matter whether you communicate something nice or bad ... employees have to, or not just employees, the whole team, has to have trust in each other" (group advisor).

Second, participative leadership was supported by limited *vertical and horizontal demarcations*. For example, vertical demarcations were reduced by devolving responsibility from supervisors to groups on the shop floor. Earlier, supervisors (formally called "Meisters"; now called group advisors) would oversee and usually hierarchically control these processes. With the introduction of Star Trek, control was devolved to groups of operators which were headed by a group speaker (usually having a "Facharbeiter" qualification). While the role of the supervisors had changed from a line to a more advisory role, the remaining supervisors still formed an important link between workers and middle management.

As regards horizontal demarcations, the reorganization of the maintenance unit and its integration into production were crucial. The reorganization not only reduced the hierarchy but "internalized the interface" between the maintenance and production (group advisor). Earlier, all process changes were controlled and approved by the head of maintenance. The integration of maintenance into production facilitated cross-functional interaction and created a day-to-day improvement capacity close to the production process. Also, prior to the introduction of Star Trek, production groups were separated much more strictly into departments – there was "a wall between different departments" (operator).

Overall, the reorganization measures lowered vertical and horizontal demarcation in the organization increased the social interaction and cohesion across functions, departments and hierarchical levels.

Third, on top of the structural changes, the social interaction of the different occupational groups in the newly composed production department was facilitated by the introduction of a common "group-bonus system" based on the entire factory's performance with regard to key performance indicators and flexibility (works council). An operator also stated in this context that the group bonus system enhanced social interaction as "fitters react to any gout" now. Another effect of the bonus system was seen in its function of making "people think and cooperate across shifts and departments" (operator), which indicated increased social cohesion as compared to the situation earlier when bonuses of production and maintenance were not aligned.

Table 4 about here

Learning at the UK Sub

Knowledge absorption at the UK Sub

Confronted with decreased production volumes and the threat of closure, the UK Sub was motivated by much the same incentives as German Sub to acquire and adopt the centrally initiated Star Trek principles. Similar to the German subsidiary, the UK subsidiary was briefed on the Star Trek initiative by headquarters and received extensive documentation. This was then followed by site visits by the consultancy firm involved in the early phase of

the implementation process. At the UK site, information on Star Trek was disseminated top-down through meetings and briefings, and several consultancy firms provided additional seminars and training modules on continuous improvement and lean manufacturing.

At UK Sub, the acquisition of Star Trek translated first and foremost in a strong focus on performance indicators, such as service levels and stock levels. The development of applications of the Star Trek principles saw much involvement of external consultancy firms, and predominantly manifested itself in ambitious target-setting and technical adaptations, rather than in novel applications and the creation of a shared vision as at the German site. For instance, standard operating procedures were redesigned, and on the initiative of the improvement manager of the paints division, work started on the creation of a '5C' area based on the 5S principles of workplace design. A consultancy firm set new production targets which, together with work schedules and performance indicators, were posted on notice boards on the shop floor. Operators followed training programmes to improve technical skills and multi-skilling. The training programmes also created awareness of the importance of a clean workplace and a "mental recognition of the importance of zero stock" (shift leader). Finally, employees were offered the possibility to create and volunteer for process improvement groups (PIGs) to encourage incremental improvements.

However, whereas at German Sub the locally developed continuous improvement practices outlasted the Star Trek initiative, the solutions developed at the UK site failed to institutionalize, and the continuous improvement initiative was not sustained. For instance, the implementation of '5C' areas was discontinued after the responsible consultancy firm and improvement manager left the site. Although one corner of the ground floor had been successfully transformed into a '5C' area, the initiative did not produce the intended shop

floor-wide shift in attitude. In the words of one operator: “if you spill there [the 5C area], you clean it up; but if you spill somewhere else, you just leave it”.

Along similar lines, the communication of targets and schedules through notice boards did little to motivate the operators, and even became a source of frustration. For example, workers on the shop floor indicated that the new externally set filling speed was unrealistic, because “at that speed, paint would spill over the cans” (team leader). As an operator explained, “the target filling speed set by [the consultancy firm] is set at 40 tins per minute, whereas we can normally and reasonably do 22-28, perhaps 30.” Management nonetheless decided to leave the new target filling speed unchanged, with the result that on occasion “numbers were reported while the machine hadn’t even operated” (team leader).

In addition, many of the redesigned standard operating procedures (SOPs) which were aimed at increasing efficiency and safety, could not be sustained. Newly introduced SOPs were noted but not adhered to by operators. One operator explained that “they are brought in, people hear about it, but people tend to do it their own way”, and that operators often “cut corners” to “get the job done”. Furthermore, SOPs were not communicated to new employees, even though new operators underwent extensive on-the-job training programmes which—depending on the machine—could last several weeks. For example, when asked about SOPs one of the new operators replied: “nobody has ever told me. You do what you see other people do.” Similarly, another operator explained that “everybody has his own way, and people are trained differently”.

Overall, the UK site showed limited transformation and application of the Star Trek initative. Although many operators underwent some form of training in the light of HQ’s Star Trek initiative, over half of the operators interviewed were unaware of Star Trek or its principles, and those who were aware often claimed to “do very little differently” (operator) compared with before. In all, in the words of the business unit’s improvement manager: “If

I had [to rate the extent to which the principles had been taken on board on] a scale from 1 to 10, then I would say we are on 1 out of 10".

Social interaction at the UK Sub

A striking difference between the German and the UK site was the *type* of actors that were involved in the acquisition, transformation, and application of the Star Trek principles. Whereas the German site involved actors from across the hierarchical range, the transformation of the Star Trek initiative at the UK site remained largely in the hands of management and external consultants. External consultants suggested setting new production targets and using visual communication. Education on 'zero stock' was provided by an external institute, and new cleanliness and safety measures were imposed by external consultancy firms rather than developed locally. Even the re-writing of SOPs saw little involvement of experienced operators. Operators were empowered to initiate and participate in process improvement groups, but these mainly focused on incremental improvements such as waste recycling in the canteen. Thus, although many operators participated in the externally organized training programmes, operators were, for the most part, not involved in translating the Star Trek principles at the UK site. As one operator commented, "Many of the suggestions made by [an external consultancy firm] had already been made by other operators ... but had not been acted on by management".

In addition, *social cohesion* at the UK site was compartmentalized and characterized by strong hierarchical and moderate functional demarcation. Contrary to the German site, management was not involved with the shop floor and preferred communication via e-mail to face-to-face contact. In addition, management—which often socialized after work—was perceived to unconditionally side with shift supervisors (lower management) in the case of conflict, and preferred to distance itself from shop floor activities. Among operators, on the

other hand, there was a strong culture of 'not telling on your colleague' and a strong sense of distrust towards management. The strong degree of demarcation at the UK site severely hampered cross-hierarchical and cross-functional communication. Operators frequently complained about the lack of information from management, claiming: "we just don't find out!" (operator), and expressed their frustration that suggestions from the shop floor were rarely taken on board.

Finally, interaction across functional and hierarchical groups at the UK site was strongly tied to *individual projects*. Whereas at the German site interaction between actors from different hierarchical and functional levels had become commonplace, at the UK site improvement initiatives were always *infrequent* and limited in time. For instance, the involvement of consultants at the UK site was time-bound by nature, and produced piece-meal solutions such as setting over-ambitious targets or filling speeds. Similarly, process improvement groups (PIGs), which often involved actors from different functional areas, would dissolve when a problem had been resolved. This limited the ability of actors to engage in the transformation and application of the Star Trek principles beyond the specific task of the group, and hence to develop locally sustained applications of the Star Trek principles. In addition, the PIGs were particularly vulnerable to time and resource shortage because they were not part of day-to-day working activity. They were often neglected when time and personnel shortage increased, which contributed to the fact that "the PIGs died before they started" (operator).

Organizational conditions at UK Sub

The limited scope of social interaction at the UK Sub was mirrored in the absence of organizational conditions that would enable and encourage the participation of employees in transforming the Star Trek principles. First, at the UK Sub participation in the

transformation of the Star Trek principles was not supported by an *incentive system*. Contrary to German Sub for instance, at the UK Sub there was no bonus system for meeting performance targets. Rather, for operators, the implementation of Star Trek resulted in a loss in shift payments, and the operators could not help but equate improvement with job loss.

Second, in contrast to German Sub, there was little sign of *participative leadership* or a strong human orientation on the side of management. Instead, management's approach to managing operations was distinctly hands-off, with operators suggesting that management had "no clear idea of what people are actually doing" and that "a lot of people can get away with things, work-wise". In addition, lower management was often perceived to rely on 'divide-and-conquer' tactics. For instance, management suggested that the more vocal blue shift was a problem-shift, even though performance indicators on the notice boards did not indicate any actual performance difference between the two shifts. Even headquarters characterized management at the UK site as "very traditional, political animals [and] not very good listeners" (European Improvement Manager).

A final constraint on widespread social interaction and involvement at the UK Sub was the sharp *structural separation* between functional areas. Whereas at German Sub, structural demarcations had gradually dissolved (following for instance the integration of maintenance and production), at the UK Sub, strong structural demarcations continued to exist. For instance, maintenance and quality control operated independently from the shop floor, outside the shift-structure, and were physically removed from the production line. Even operators of different functional areas on the same shift had little need or opportunity for cross-functional cooperation on the job. This severely limited social interaction and the integration of maintenance and production know-how.

DISCUSSION

What emerges from the case findings is that the difference in learning outcomes at the two subsidiaries is inherently linked to differences in social interaction among the actors involved in learning activities (Table 5). At German Sub, where the transfer initiative was extensive, actors from across the hierarchical range were involved in the transformation and application of the Star Trek initiative. There was a strong sense of social cohesion, and frequent—sustained—interaction between employees on issues related to the transfer initiative. Instead, at UK Sub the transfer initiative was not sustained. Here the transfer initiative saw little involvement of operators, and there was little social cohesion due to strong hierarchical and functional demarcation. In addition, cross-functional interaction was usually project-based and short-lived.

Table 5 about here

To understand why the differences in social interaction patterns translated into different learning outcomes, it is particularly insightful to adopt a social learning perspective (e.g. Gherardi and Nicolini, 2001; Elkjaer, 2005). Social perspectives on learning have recently received more attention in the literature on MNE knowledge processes (e.g. Hong, Easterby-Smith and Snell, 2006; Saka-Helmhout, 2007; Noorderhaven and Harzing, 2009). Such perspectives highlight that "learning does not take place solely or principally in the minds of individuals but rather stems from the participation of individuals in social activities" (Gherardi and Nicolini, 2001: 35). For organizational learning to be extensive,

knowledge must be integrated locally: it must be acquired, transformed, and subsequently applied and sustained into actual practice, which inherently rests on social interaction. In other words, organizational learning is a social rather than an individual exercise, and therefore the locus of organizational learning is not the mind of the individual but rather the "participation patterns of individual members of organizations in which learning takes place" (Elkjaer, 2005: 43).

This suggests that the social interaction pattern at German Sub led to extensive learning because it enabled employees to engage in the transformation of the transfer content and in the development of applications which were truly local, and which workers perceived as their own. What is more, the case findings suggest that it is not merely the frequency or strength of social action, but the scale and *scope* of social interaction patterns in terms of who how often interacts and the social relations among actors that matter: At the UK Sub, where participation in learning activities was limited to management and external consultants, the acquired knowledge underwent very little transformation. Applications of the acquired knowledge were relatively generic in nature, and remained close to the original Star Trek initiative. Instead, at German Sub, participation of and interaction among a wide range of local actors resulted in substantial transformation of the acquired knowledge, and the development of applications that were both innovative and local.

The implication for understanding the micro-foundations of absorptive capacity is that subsidiary level absorptive capacity is a function of both the diversity of knowledge of employees who participate in learning activities and of the social interaction patterns between these employees. While absorptive capacity at the individual level is largely dependent on the diversity of individuals' knowledge structures (Cohen and Levinthal, 1990), absorptive capacity at the subsidiary level is not simply the sum of the knowledge

and capabilities of individual employees. Diversity of knowledge and expertise increases subsidiaries' ability to develop new applications (Cohen and Levinthal, 1990), while social interaction enables employees to engage in the transformation and application of new knowledge; i.e., the level and scope of social interaction enables or constrains the ability of employees to transform the transferred knowledge at the local context. Thus, the larger the scale and scope of social interaction surrounding learning-related activities, the more extensive the transformation new knowledge can undergo, and the more extensive local applications arise. This leads us to propose the following:

Proposition 1: Subsidiaries' absorptive capacity is positively related to the scale and scope of social interaction among employees.

A key reason for the difference in social interaction patterns between the two subsidiaries is to be found in the organizational conditions at both subsidiaries. At German Sub, local conditions such as participative leadership, the incentive system and low structural demarcation encouraged social interaction across hierarchical and functional divides, and thus facilitated the ability and willingness of employees to participate in the transformation of new knowledge. At the UK Sub, however, such enabling organizational conditions were largely absent, which contributed to the lack of involvement of operators in the transformation of the Star Trek principles. In the context of absorptive capacity, research has predominantly focused on the organizational conditions that influence *individual* employee abilities and motivation. But similar to that "neither employees' ability nor motivation by themselves is sufficient to facilitate knowledge transfer" (Minbaeva et al., 2003: 596), the ability and motivation of individual employees only contributes to absorptive capacity at the subsidiary level if employees are also enabled and motivated to

engage in the transformation of new knowledge. The case findings illustrate the influence of organizational conditions on subsidiaries' absorptive capacity where they enable and motivate social interaction and participation for the adoption, transformation and application of knowledge. This leads to the following proposition:

Proposition 2: Subsidiaries' absorptive capacity is positively related to organizational conditions that motivate and enable *employees to engage in the transformation and application of new knowledge.*

CONCLUSION

While the importance of MNE knowledge processes is widely recognized (e.g. Kogut and Zander, 1993; Grant, 1996), we still know little about the role of local actors in these processes and how this is contingent on organizational conditions. Although the notion of absorptive capacity in IB studies may partially address these issues, the absorptive capacity literature itself is unclear about the role of social interaction and is inattentive to how individual behaviour translates to absorptive capacity at the organizational level. This study makes several contributions to the advancement of both the IB knowledge transfer and absorptive capacity literature.

First, this study provides qualitative evidence of the importance of insight in the participation pattern of local actors and of social dynamics in understanding subsidiary learning. In particular, the case findings suggest that different patterns of social interaction are related to the variation in subsidiaries ability to adopt and apply new knowledge. Social interaction enables local actors to participate in the transformation of new knowledge at the local context and is therefore crucial in ensuring that individual absorptive capacity

translates into absorptive capacity at the organizational level. Thus, while previous studies argue that social interaction patterns affect units' absorptive capacity indirectly, by facilitating knowledge sharing and promoting mutual understanding (e.g. Zahra and George, 2002; Todorova and Durisin, 2007), this study illustrates that social interaction constitutes a key link between the micro- and the macro-level, and is therefore a key requirement for organizational absorptive capacity.

Second, we illustrated that to understand how and why social interaction is enabled or constrained it is crucial to consider organizational conditions. As the case findings suggest, the ability and motivation of individual employees only contributes to absorptive capacity at the subsidiary level if employees are also enabled and motivated by organizational conditions to engage in the transformation new knowledge. Thus, our study adds to a growing number of studies that call for a micro-perspective to understanding IB knowledge processes (e.g. Minbaeva et al., 2003; Foss and Pedersen, 2004) by suggesting *how* differences in certain organizational conditions, such as leadership style and structural demarcations, lead to differences in the absorptive capacity of MNE subsidiaries.

The results of this study have several important implications for practitioners. As others have demonstrated, the ability of organizational units to acquire and apply new knowledge is positively related to learning (e.g. Lane et al., 2001), innovativeness (e.g. Lichtenthaler, 2009; Tsai, 2001) and profitability (e.g. Bergh and Lim, 2008; Lichtenthaler, 2009; Tsai, 2001). This study illustrates that organizational conditions that facilitate and encourage social interaction among employees are key to organizational units' absorptive capacity. As argued in both the absorptive capacity and social learning literatures, new knowledge needs to be transformed at the local context in order to be accepted and successfully applied. Social interaction among employees in terms of both scale (in terms of frequency and number of employees) and scope (in terms of diversity in employee

backgrounds) is a prerequisite for this. The acceptance and application of new knowledge can be actively encouraged and facilitated by practicing managers through, for instance, the adoption and promotion of a participatory leadership style, limiting of structural demarcations between functional areas, and the development of appropriate incentive systems, such as group bonus systems that reward collective rather than individual performance.

While the case findings demonstrate the importance of social interaction patterns, our results also give rise to several new directions for further research. First, as the key strength of case-based research is in theory building and the development of well-founded propositions rather than theory testing (e.g. Ghauri, 2004; Siggelkow, 2007), we encourage quantitative studies to examine the extent to which the case findings can be generalized. Second, although the organizational conditions identified in this study emerged as most relevant to understanding the difference in social interaction patterns between the focal subsidiaries, it is likely that other factors, such as HRM practices, also impact social interaction. We therefore also encourage further work on the interplay between social interaction patterns and organizational conditions in order to gain more comprehensive insight into the contingencies that structure social interaction patterns. In addition, it would be wrong to assume that subsidiaries operate in a vacuum. A related question therefore is how the wider cultural and institutional environment in turn structures such organizational contingency factors. Finally, although social perspectives on MNE knowledge processes are still relatively scarce, such studies are on the rise (e.g. Hong et al., 2006; Noorderhaven and Harzing, 2009; Saka-Helmhout, 2009). As this study illustrated, by highlighting how local actors and local conditions affect learning at the organizational level, social learning perspectives may prove valuable in future studies to better understand both the role of local actors and organizational conditions in MNE knowledge processes.

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Table 1: Key subsidiary characteristics

	German subsidiary	UK subsidiary
Subsidiary characteristics		
Size	411 employees	324 employees
Acquired by Dutch Chem	1998	1994
Activities	Wall paint and lacquer plant	Wall paint and lacquer plant
Skill levels	Majority of workers semi-skilled, with an average of 18 years of employment in the subsidiary	Majority of workers semi-skilled, with an average of 15 years of employment in the subsidiary
Technology	Semi-automated mixing and filling units	Semi-automated mixing and filling units
Context	High threat of plant closure and massive job loss, strong sense of competition between sites	High threat of plant closure and massive job loss, strong sense of competition between sites
Knowledge transfer initiative		
Knowledge content	Continuous improvement principles	Continuous improvement principles
Sending unit	Headquarters	Headquarters
Transfer channel	Documentation, personnel transfer, local workshops	Documentation, personnel transfer, local workshops
Learning outcome	Extensive transformation and application of the transfer initiative	Limited transformation and application of the transfer initiative

Table 2: Overview of informants and secondary data

	Headquarters	German subsidiary	UK subsidiary
Informants	Supply Chain Europe Director*	Site Manager*	Site Manager*
	European Improvement Manager*	Plant Director*	Operations Director*
		2 Factory Managers*	
		2 Group Advisors*	2 Shift Managers*
		HR Manager*	3 Team leaders
		10 Operators	12 Operators
Documents	Organization charts	Organization charts	Organization charts
	Star Trek Roadmap (Outline of Star Trek initiative: Vision, Objectives, Targets, Action Plans, Improvements)	Masterplan continuous improvement Germany	Masterplan continuous improvement UK
	Star Trek strategy paper (Production and Logistics Strategy of Division for Europe)	Production role model Cologne (behavioural guidelines)	Documentation on Standard Operating Procedures
		Graphs on production related indicators	Graphs on production related indicators
	Newsletters of Division Production, Logistics and Supply Chain	Newsletter of local site	

*Formal interviews of between 30 minutes and 2 hours.

Table 3: Overview of knowledge content and learning outcomes

	Transfer knowledge	Local applications	Learning outcome	Representative informant quotes
UK site	Continuous improvement systems and tools: ▪ Kaizen ▪ Six Sigma ▪ 5S ▪ Lean manufacturing	External target-setting Communication of targets and schedules Redesign of Standard Operating Procedures Formation of process improvement groups	Limited learning	'We can't produce that fast because at that speed, paint would spill over the cans' 'There are graphs on the wall, but I don't understand them' 'they [SOPs] are brought in, people hear about it, but people tend to do it their own way'
German site	Continuous improvement systems and tools: ▪ Kaizen ▪ Six Sigma ▪ 5S ▪ Lean manufacturing	Development of strategic vision and slogan Creation of a continuous improvement culture Formulation of behavioural guidelines	Extensive learning	'They have translated our whole Star Trek program into their own program for the Cologne site, with a vision, with how they operate, what they do, how they measure the success' 'If a production run fails, costing about 30.000 to 40.000 Euros, workers are not punished anymore. Instead, they enter the office without hesitation and admit something has gone wrong.'

Table 4: Social interaction patterns and organizational conditions

	Social interaction patterns		
	Participating actors	***Social cohesion***	***Strength and persistence of social interaction***
German site	**Actors across the hierarchical range**; limited involvement of external consultants	**Strong** hierarchical and functional integration	Cross-hierarchical and cross-functional **day-to-day interaction**
UK site	Largely limited to **management and external consultants**	**Weak** integration with shop floor; strong hierarchical demarcation	**Project-based**; cross-hierarchical and functional interaction on temporary basis only

	Organizational conditions		
	Structural demarcation	***Leadership style***	***Incentive system***
German site	**Low** vertical and horizontal structural demarcations	**Participatory** leadership style, open communication	A **group-bonus system** based on performance of the entire factory
UK site	**High** structural demarcation between functional areas	**Hands-off** leadership style, **divide-and-conquer** tactics	**No incentive system**, implementation of Star Trek hand-in-hand with a **loss in shift payments**

Table 5: Summary of findings

	Learning outcome	Social interaction	Organizational conditions
German site	**Extensive** learning	**Extensive social interaction** in terms of both scale and scope	**Enabled and encouraged** participation
UK site	**Limited** learning	**Limited** in scale and scope	**Few** organizational conditions to enable and encourage participation

APPENDIX: Illustrative list of codes

Main categories	Sub-categories	Illustrations German Sub	Illustrations UK Sub
Absorptive capacity	Acquisition	"We had some problems in our German operation to be profitable in the market, so there was a lot of pressure on the German site to improve." "It was to believe in something or to leave the company. That is where it started with me [the plant manager]. And then I tried to get some people who wanted to start the same dream."	"We have been putting a lot of effort in conveying the message to all levels of the organisation, I think we have spent hell of a lot of time and effort in conveying the message that basically this is a good thing, because we are not going to close your site down. You will get a chance. If we do the right steps in the right order and we show results, then we are away, we are flying. That message has been communicated top down pretty good I think."
	Transformation	"[The people at German Sub] have translated our whole Star Trek program into their own program for the Cologne site, with a vision, with how they operate, what they do, how they measure the success" "I would say that 'Star Trek' has no meaning for the people. I know that other sites did that differently but we very deliberately took the decision not to sell it under the label Star Trek."	"There is a lot from headquarters that is relevant but we are asked further questions like 'Where do you see yourself in the future? What is your local vision?' We don't know how these translate to the operational level." "Either principles have not been translated into shop floor objectives or there is a fear factor at first-line and middle management levels."
	Application	"Earlier, if a change in the recipe was required because it didn't work … it was difficult to discuss these changes with the laboratory. They didn't care much or were not very responsive to the demands and requirements of producing a recipe that works well in the laboratory to the large scale of production. This has changed fundamentally" "The resolutions of problems and changes to the process have gotten much faster and more flexible"	"We have made a few demonstrations, improvement projects here and there. But it has not become a way of life" "[New standard operating procedures] are brought in, people hear about it, but people tend to do it their own way" "We can't produce that fast [at the newly imposed target filling speed] because at that speed, paint would spill over the cans"

Social interaction patterns	Participating actors	"[Some of the new initiatives] come from the leader-level in filling and in production, but for the most part it comes from the people working on the machines who work with them day-in day-out with them and say 'Listen, I have a problem here can't we do this or that'. Most of the time it comes from the shop floor." "In my view the role model has been developed out of the midst of the site."	"Many of the suggestions made by [the external consultancy firm] had already been made by other operators … but had not been acted on by management" "I was involved in rewriting [standard operating procedures] at [my previous job], where they use the exact same machine as well and where I used to be a training officer, but I am not involved in the rewriting here."
	Social cohesion	"that's the nice thing now they all help each other. Earlier the colouring guy wore the colouring hat and would say 'why should I carry the barrel?' " "For me it was important, when you were in the past in the factory building: here was the mixing process, here the colouring process and here the filling. These were three levels. When the one pushed the barrel wagon, the barrel, the other one did this and a third one did that and they didn't help each other much."	"Higher management should have an independent position [but] they unconditionally side with lower management ... because lower and higher management are friends; [they] hang out together" "We call them [names], they call us"
	Strength and persistence of social interaction	"I now call [a group advisor] and say 'Listen, I have a big problem downstairs at the robot-palletizer, can you please send someone there?' and he also sees or identifies this for himself as the main problem. And that's what we have achieved."	"Most of the time we hear things by word of mouth rather than through briefings or notes. I'm briefed about two times a year, if I'm lucky." "The PIGs [cross-functional process improvement groups] died before they started"
Organizational conditions	Structural demarcation	"Just an example, the reorganization of the maintenance department. … This reorganization is also a change of pattern. We used [some] out of the [original] team, the rest we split over the factory and integrated into the process. That brought instability because the factory leader was all of a sudden responsible for maintenance, and the maintenance people all of a sudden, when there was no … down time or whatever, they were also expected to … to produce the product."	"[The new shift manager] doesn't really know what's going on, because [he] came from maintenance rather than from the shop floor."

Leadership style	"The most important thing is that you take people on board; if you don't do that you don't even have to start ... . you have to listen to them , you have to talk to them and you have to give feedback be it positive or negative."	"[Management] should listen more, because currently management does not listen to suggestions and operatives are not asked about issues."
Incentive system	"People perceive these things [bonuses] and are now really capable to select themselves what are the things that maybe hurt me and which are the things we can say 'OK, let's not make a fuss over it.'" "They were also integrated into the group-bonus system. They get their fair share if performance is alright and that has its *Eigendynamic* [own dynamics]. All discussion aside that money is just a short term motivation; but it motivates the people quite a lot."	"I like my new job, especially the medical care, pension care, health and safety. But if you work here for a long time, you don't see the benefits anymore and just become sceptical." "[The knowledge transfer initiative] has also meant a loss in shift payments. This was a lot of concern to the operators."

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