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# Problem solving in MNCs: How local and global solutions are (and are not) created

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**Abstract**
It is widely acknowledged in the international business literature that subsidiaries can make a strategic contribution to multinational corporations (MNCs). Departing from the common focus on subsidiary role, contexts and organizational MNC factors, this study explores the micro-level details of managers' actions and interactions. We conducted an in-depth qualitative study into 38 problem-solving processes employed across four subsidiaries. Taking a non-routine problem-solving perspective on how subsidiaries contribute strategically to renewing MNC competences, this paper uncovers four problem-solving approaches: local template adaptation; superior technology creation; local template creation; and global principle creation. The findings depict how the way problems are framed influences knowledge search and solution-finding activities, and how these different activities may result in local and global solutions. The paper extends insights into MNC innovation and subsidiary initiative by detailing how subsidiary managers navigate different problem-solving approaches, and contributes to discussions on the micro-foundations and social aspects of MNC knowledge flows, revealing factors that trigger distance-spanning knowledge search.
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## INTRODUCTION

This paper focuses on non-routine problem solving, which is seen as a critical activity for developing and renewing the knowledge and competence bases of any established organization (Cyert & March, 1963; Felin & Foss, 2009; Lampel, Shamsie, & Shapira, 2009; Nelson & Winter, 1982). Zooming in on non-routine problem solving reveals a complex process whereby activities to frame the problem, find and scope a solution, as well as to search for knowledge, all interact to shape the final outcome (Nickerson, Yen, & Mahoney, 2012; Nickerson & Zenger, 2004). However, the primary focus of much MNC research has been on knowledge-sharing and knowledge integration more generally (cf. Kogut & Zander, 1993), requiring a more nuanced view of the intricacies of non-routine problem solving in MNCs in order to capture these micro-level complexities, to disentangle different activity patterns and their implications.

Non-routine problem solving is also a way in which subsidiaries can contribute strategically to their multinational corporations

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(MNCs), yet little is known about the details of non-routine problem-solving processes in MNCs compared with other important and frequently researched processes, such as MNC innovation (Bartlett & Ghoshal, 1998; Ghoshal & Bartlett, 1988; Nohria & Ghoshal, 1997) or subsidiary initiative (Ambos, Andersson, & Birkinshaw, 2010; Birkinshaw, 1997, 1999; Birkinshaw, Hood, & Jonsson, 1998). This paper addresses this lack of attention by posing two research questions: (1) how do subsidiary managers approach non-routine problem-solving processes; and (2) how do the various approaches contribute towards renewing MNC competences?

We conducted an in-depth qualitative study into 38 problem-solving processes employed across four subsidiaries to unravel the complexities in activities pursued by subsidiary managers in seeking solutions, contributing to the international business (IB) literature in two important ways.

First, by focusing on individuals' micro-level actions and interactions in their solution-finding efforts, this paper contributes to our understanding of the subsidiary's role in MNC competence renewal, the bottom-up processes of building and changing competences (Burgelman, 1991). This adds to previous MNC innovation and entrepreneurship process frameworks (Bartlett & Ghoshal, 1998; Birkinshaw, 1997; Nohria & Ghoshal, 1997). We identify and disentangle the intricacies of the various approaches that subsidiary managers pursue to lead their units' problem-solving efforts: local template adaptation, superior technology creation, local template creation and global principle creation. Importantly, we uncover how some approaches are more likely to develop locally implemented solutions, and which approaches create global solutions and so renew MNC competences.

Second, this paper develops insights into the micro-foundations and social aspects of knowledge processes in MNCs, an important theory development area (Foss & Pedersen, 2004; Noorderhaven & Harzing, 2009). Analyzing managers' knowledge search in response to these non-routine problems (Cyert & March, 1963; Nickerson & Zenger, 2004), we offer an understanding of how subsidiary managers deal with a central tension inherent in mobilizing knowledge within MNCs – whether to search geographically and cognitively close or distant – and what factors trigger distance-spanning actions to more likely locate diverse knowledge for recombination into new solutions.

The next section introduces the theoretical background (how investigating problem solving extends previous research on subsidiaries' strategic contributions to MNCs), and outlines the main activities and challenges characteristic of problem-solving processes. We then discuss our methodology, provide a detailed representation of our findings and our framework of problem-solving approaches, before discussing the results in the light of existing theory, and drawing implications for management practice and for future IB research.

## THEORETICAL BACKGROUND

### Approaches to Understanding the Strategic Contribution of Subsidiaries

It is acknowledged that subsidiaries are the locus of many strategic activities that create and renew MNCs' knowledge and competences, most generally through innovation (Bartlett & Ghoshal, 1998; Ghoshal, 1986; Ghoshal & Bartlett, 1988; Nohria & Ghoshal, 1997) and initiatives (Birkinshaw, 1997, 1999; Birkinshaw et al., 1998; Rugman & Verbeke, 2001). While a focus on these processes provides invaluable insights into the strategic contributions that subsidiaries make to MNCs, we argue that this line of inquiry can be extended in important ways by investigating non-routine problem-solving processes.[1]

Problem solving is a *broader phenomenon* than innovation or initiative generation. From the perspective of problemistic search (Cyert & March, 1963), discrepancies between organizational expectations and reality (usually caused by changes in the external environment) motivate adaptive behavioral responses. In particular, such adaptive actions are stimulated by *non-routine problems* – novel or unique situations for which current organizational practices and routines offer no predetermined responses (Nelson & Winter, 1982). Unlike initiative, which is a "relatively rare" phenomenon that many subsidiaries never actively pursue (Birkinshaw, 1997: 208), or innovation that captures subsidiary successes, non-routine problems regularly occur in subsidiaries operating in today's more dynamic markets.

Non-routine problems are also of *strategic value*. Interrupting the ingrained and routinized practices and processes that predetermine most organizational activities, these events are powerful occurrences, because they unveil weaknesses in current routines, and so represent opportunities to engage in productive solution-finding activities that can

create solutions that renew the organization's competences (Felin & Foss, 2009; Lampel et al., 2009; Nickerson et al., 2012).

Focusing on problem-solving processes thus allows us to investigate an important phenomenon of how subsidiaries, without necessarily having a role to innovate, can still contribute strategically to MNCs. It allows us to depart from a focus on subsidiaries with a role or mandate for innovation, including investigations of centers of excellence (Frost, Birkinshaw, & Ensign, 2002; Holm & Pedersen, 2000) and "superstar" subsidiaries (Blomkvist, Kappen, & Zander, 2010), from analyzing the influence of organizational MNC factors (Bartlett & Ghoshal, 1998; Ghoshal & Bartlett, 1988; Nohria & Ghoshal, 1997) and subsidiary context (Birkinshaw, 1997, 1999; Birkinshaw et al., 1998), to address calls for detailed examinations at the lower levels of subsidiaries to appreciate the nuances and complexities of different contributory activities, and develop more theoretical insights into the nature of these actions and interactions, and their impact for wider MNC-level outcomes (Birkinshaw, Brannen, & Tung, 2011; Rugman & Verbeke, 2001; Rugman, Verbeke, & Wenlong, 2011).

## Problem Solving in the MNC

Solving non-routine problems involves a complex and interdependent process, including framing the non-routine problem, searching for a corresponding solution and solution scoping.

### *Framing non-routine problems*

Once a non-routine event is experienced, subsidiary managers have to frame the non-routine problem: to understand and define its nature, scope and boundaries by building a conceptual interpretation (Baer, Dirks, & Nickerson, 2012; Cowan, 1990; Lyles, 1981; Lyles & Mitroff, 1980; Smith, 1988, 1989; Vaccaro, Brusoni, & Veloso, 2011). Initially, because of the ambiguities, complexities and ill-structured nature of problems (Simon, 1973), it can be difficult to comprehend them accurately, or to initiate appropriate actions to stimulate the development of solutions. Outcomes often remain restricted, because individuals are biased towards believing that only little can be learned from any particular problem situation (Starbuck, 2009). Yet subsidiary managers who take the trouble to gain a richer understanding of non-routine problems, and to interpret the various different aspects of such complex situations, are more likely to enable organizational learning (Beck & Plowman, 2009). Such challenges make high demands: their local and global complexities need to be disentangled, and the problem needs to be decomposed into more or less familiar and interdependent subproblems (Newell, Shaw, & Simon, 1958; Simon, 1962; Simon & Barenfeld, 1969). Social interactions with peers, who can draw on their own expertise, usually help to define the problem space more accurately (Cross & Sproull, 2004; Dunbar & Garud, 2009), and so facilitate more productive solution finding.

### *Solution-finding activities, including search for knowledge*

Solution-finding activities are the actions for identifying and developing solutions that incorporate knowledge search (Cyert & March, 1963; Nickerson & Zenger, 2004). Knowledge search is defined as all the actions of looking for and identifying what knowledge can potentially be accessed (Hansen, 1999), where the term "knowledge" refers to know-how, expertise or best practices/routines (Gupta & Govindarajan, 1991, 2000), and may be tacit or codified (Polanyi, 1966). Search involves balancing the time and effort spent seeking and evaluating knowledge (Hansen, Mors, & Løvås, 2005) with the search pattern, depending on what kind of solution is intended to be developed (Gray & Meister, 2006; Haas & Hansen, 2007). Although managers may prefer to copy existing solutions (Spender, 1989), the novelty of non-routine problems often requires them to gather knowledge for solution creation by developing new combinations of existing knowledge (Galunic & Rodan, 1998; Henderson & Clark, 1990; Kogut & Zander, 1993). If solution creation is required, subsidiary managers need to be willing and able to access the MNC's distributed and diverse knowledge pockets to increase their chances of identifying dissimilar but suitable knowledge for recombination.

The proximity perspective of economic geography provides a useful framework to consider the dynamics of knowledge search when the knowledge required may be highly heterogeneous and/or highly dispersed (Audretsch & Feldman, 1996; Morgan, 2004), and aligns with observations that multiple dimensions of distance matter to MNC functioning (Dellestrand & Kappen, 2012; Ghemawat, 2001; Nachum & Zaheer, 2005; Tsang & Yip, 2007; Zaheer, Schomaker, & Nachum, 2012). Proximity is multidimensional (Boschma, 2005), and one dimension is the *geographic proximity*, the

physical distance between knowledge searcher and knowledge holder. Located at the corporate periphery, subsidiary managers usually only have access to a limited pool of geographically co-located knowledge sources (Gupta & Govindarajan, 2000; van Wijk, Jansen, & Lyles, 2008), although they are likely to have peers, seniors, direct reports and other colleagues dotted around the globe with whom they interact as part of their normal operations. To search the distributed spectrum of MNC knowledge, managers need to span geographic space; but studies demonstrate that geographic distance impedes knowledge flows in MNCs (Hansen & Løvås, 2004; Monteiro, Arvidsson, & Birkinshaw, 2008), because it involves less frequent and intense interpersonal interactions, which normally provide a valuable channel for knowledge search.

In addition, the novelty of the non-routine problem may necessitate crossing the boundaries of the unit's own specific domain. This relates to the second dimension of proximity – *cognitive proximity* – a similarity in the knowledge base and expertise between knowledge searcher and holder (Boschma, 2005; Nooteboom, 2000). Knowledge search tends to be localized, however (Cyert & March, 1963), with managers primarily scanning sources that resemble their own cognitive settings. Search across cognitive distance requires trans-specialist understanding, to be able to assess which other disciplines might offer valuable knowledge (Postrel, 2002), as well as searching knowledge of increased perceived novelty, which adds substantial complexity and ambiguity to the process (Carlile, 2002). Despite these challenges, cognitively distant search may be more likely to reward the effort, as it can enable the creation of innovative solutions if valuable related knowledge can be identified and recombined (Nooteboom, Van Haverbeke, Duysters, Gilsing, & van den Oord, 2007; Wuyts, Colombo, Dutta, & Nooteboom, 2005).

Figure 1 summarizes how knowledge searches are characterized both by geographic proximity/distance and by cognitive proximity/distance. In addition to internal sources, solution-finding activities may draw on existing relational links with external organizations (Andersson, Forsgren, & Holm, 2002; Meyer, Mudambi, & Narula, 2011). Subsidiary managers may act as boundary spanners, searching both within (Kostova & Roth, 2003; Mudambi & Swift, 2009) and beyond the firm (Tushman & Scanlan, 1981), bridging different functional, geographic and organization boundaries,

| | Geographic proximity | Geographic distance |
|---|---|---|
| **Cognitive distance** | • Cross-functional knowledge search, across different focal subsidiary subunits<br>• High innovation potential | • Cross-functional knowledge search, within other MNC unit(s)<br>• Very high innovation potential |
| **Cognitive proximity** | • Local knowledge search, within same focal subsidiary subunit<br>• Danger of inertia, low innovation potential | • Knowledge search within same function, within other MNC units<br>• Moderate innovation potential |

**Figure 1** MNC knowledge sources and implications.

to search for and recombine previously unconnected knowledge.

### *Scoping of solution*

Obviously, the urgency and downside threat of most non-routine problems requires subsidiary managers to develop a solution that remedies the initial, locally observed challenge; but the kind of solution created, and its potential for renewing MNC competences by producing solutions that modify or develop routines or technologies across the MNC, can vary considerably. Building on observations that subsidiaries can create knowledge that is then shared and adopted across the MNC (Ambos, Ambos, & Schlegelmilch, 2006; Edwards & Tempel, 2010; Gupta & Govindarajan, 2000; Qin, Mudambi, & Meyer, 2008; Yamin, Tsai, & Holm, 2011), scoping of the solution refers to the subsidiary managers' activities in shaping the benefits and diffusion of the solution within the MNC.

Most research into MNC knowledge processes has taken an aggregated, organization-unit focus, leading to repeated calls to explore the actual activities that promote new knowledge combinations in MNCs (Buckley & Carter, 2004; Tallman & Chacar, 2011). As the interplay of proximity and distance in knowledge search is fundamental to understanding MNC knowledge processes, it is important to examine more precisely how individuals deal with these tensions in practice, and what triggers them to go beyond their locality and span distance in their searches. Such insights will contribute towards developing theory on the micro-foundations (Foss & Pedersen, 2004) and social constitution (Noorderhaven & Harzing, 2009) of MNC knowledge processes.

To summarize, despite considerable research on the strategic contribution of subsidiaries to MNCs, there is limited theoretical or empirical understanding of the multifaceted, micro-level actions

and interactions that constitute knowledge search and problem-solving processes in the MNC; we need to understand more in these areas, especially in terms of what implications solutions may have for MNC competence renewal.

## METHODS

### Research Design, Research Setting and Sampling

We adopted a research design that involved detailed, inductive qualitative investigations (Eisenhardt, 1989) as being particularly suited to this exploratory study, which aimed to unravel the micro-level complexities of problem-solving processes. This enabled us to conduct a "close" examination of the often overlooked micro-processes that occur within MNCs (Balogun, Jarzabkowski, & Vaara, 2011; Birkinshaw et al., 2011). In line with previous studies (Birkinshaw, 1997; Ghoshal, 1986), we studied a larger number of processes – 38 in all. Importantly, and in significant contrast to other studies, we did not identify certain instances or outcomes, but allowed subsidiary managers from diverse settings to select the specific problems on which they reported, an approach that gained us detailed insights into the diverse spectrum of their problem-solving approaches.

The research setting was the Irish subsidiaries of four MNCs, and we focused on a single industry – the ICT sector – to increase the comparability of our findings, and because it offered the advantage of being a dynamic industry (Brown & Eisenhardt, 1997), where we could expect subsidiary managers to encounter novel situations regularly, increasing our opportunities to study our phenomenon of interest. As a platform for our in-depth study of a range of problem-solving processes, and to strengthen emerging theory, we selected four subsidiaries (on the theoretical sampling principle) that represented a range of different parameters at the corporate, subsidiary and managerial levels. Our four chosen subsidiaries were all wholly owned by their parent organizations and – given our interest in studying subsidiary managers' actions and interactions – had to be large enough to employ a sizeable number of managers. For study purposes, we label these organizations Epsilon, Gamma, Omega and Sigma: specific details of their locations, products and services, as well of the non-routine problems they report, are disguised or changed to preserve anonymity.

Although our chosen MNCs were alike in being more successful than their direct competitors, and in emphasizing technology and innovation leadership as strategic priorities, they still exhibited considerable variation in their organizational variables, adding constructive variance to our sample (see Table 1). At the *MNC* (corporation) level, the companies served varying business domains (including hardware, software, solution provision and services), while at the *subsidiary* level, our focal units differed in their size in terms of number of employees – an indicator of their knowledge stocks – and in the number and nature of their mandates – an indicator of range and concentration of knowledge (Gupta & Govindarajan, 1991; Hansen & Løvås, 2004; van Wijk et al., 2008). To further strengthen the transferability of our findings, the study included diverse subsidiary units – including R&D, operations, sales, services and

**Table 1** Characteristics of sample organizations

| Attributes | Domain of MNC within ICT industry | Characteristics of focal subsidiary | Characteristics of subsidiary unit(s) used for data collection |
|---|---|---|---|
| Epsilon | Solutions and services | Services, R&D mandates<br>More than 1500 employees | R&D unit with global responsibilities and high autonomy |
| Gamma | Services | Sales mandate<br>Fewer than 1500 employees | Sales unit with regional responsibilities and high autonomy |
| Omega | Hardware, software, solutions and services | Sales, services, R&D, operations mandates<br>More than 1500 employees | R&D and operations units with regional and global responsibilities and moderate autonomy |
| Sigma | Software solutions and services | Sales, services and support, R&D mandates<br>Fewer than 1500 employees | Sales, services and support units with local, regional and global responsibilities and low autonomy |

support units – which also differed in the scope of their mandates, ranging from local through regional to global responsibilities, and in their levels of autonomy, indicating different degrees of flexibility in terms of crafting solutions.

## Data Collection

Access to the four subsidiaries was negotiated with their top management, and we assured confidentiality to encourage extensive data access, and to gain more open and detailed answers from respondents. Employing a range of techniques for collecting data – interviews with subsidiary middle and senior managers, and study of archive materials – we investigated 38 problem-solving processes of specific non-routine problems encountered by the subsidiary managers we interviewed. (The initial dataset comprised 42 processes, but four were excluded because of insufficient detail in certain aspects.)

We conducted 34 semi-structured interviews – ranging from 60 to 75 min – with subsidiary middle managers. The *middle management* perspective was particularly effective for the purpose of this study, for a number of reasons. First, middle managers are closer to front-line operations, where environmental change is experienced early and non-routine problems occur regularly, so they can facilitate the interpretation of such problems in ways that trigger organizational learning (Beck & Plowman, 2009). Second, their knowledge-related activities can lead to exploitative and explorative outcomes (Mom, Van Den Bosch, & Volberda, 2007), new knowledge creation (Hedlund, 1994; Nonaka, 1994), and innovation (Kanter, 1982). Third, they are regarded as drivers of capability development and modification, as they operate at a position within large organizations where the contradicting forces of top-down stability and emergent, bottom-up change intersect (Burgelman, 1983; Floyd & Lane, 2000; Floyd & Wooldridge, 1999). Especially in large and distributed organizations like MNCs, where corporate top management is more removed from front-line operations, the onus is increasingly placed on middle managers to contribute strategically (Balogun & Johnson, 2004; Mantere, 2008; Wooldridge & Floyd, 1990), in the case of problem solving by leading and driving solution-finding actions. Drawing on Wooldridge, Schmid and Floyd's (2008: 1192) definition of middle managers, we interviewed various mid-level professionals, all of whom had both access to top management and operational knowledge, including line managers and other project-based executives whose job requirements included driving improvements. The interviewed managers had different company tenures (one up to 18 years), thus exemplifying different time spans for developing interpersonal networks and social capital. Most sampled managers were host-country nationals, some had expatriate experience, and a few were home-country or third-country nationals.

The interviews gathered information on particular aspects of one or two *specific* non-routine problem(s) dealt with by the subsidiary managers; Table 2 provides a breakdown of the various kinds of problems reported. The interviews followed a standardized core that asked all informants to first provide a detailed description of the problem that they encountered, followed by details relating to their knowledge search and solution development activities. We also gathered data on the solution, and on managers' further involvement in implementing and replicating the solutions (where applicable), towards the end of the interview. Within these categories, we ensured that the interviews remained very open, to allow managers sufficient scope to report their specific actions and interactions, and used prompts when necessary to encourage detailed and exhaustive accounts. Our initial contacts with subsidiary top management and archival material study gave us a broad understanding of the subsidiaries' strategies and main challenges, which then helped us to relate to the managers in the interview, and formulate specific prompts and probes. To guard against retrospective bias, we asked subsidiary managers to describe a concrete non-routine problem that had occurred during the last 12 months, a recent enough timeframe to allow for accurate recollection (Huber & Power, 1985; Miller, Cardinal, & Glick, 1997), and sought to further increase the accuracy of their accounts by focusing on managers' specific actions rather than on their intentions, beliefs or opinions (Golden, 1992; Miller et al., 1997).

We explored subsidiary and MNC strategies and their typical knowledge exchange patterns in seven interviews with subsidiary senior managers, typically subsidiary directors and general managers, and also used these interviews (where possible) to collect complementary data on the scope of the non-routine problems and the outcomes. These data were supplemented by our review of archival material, which included selected internal reports, project updates, communications, strategy documents and intranet information.

**Table 2** Summary of problem-solving processes: Non-routine problem dataset

| Nature of non-routine problem | Number of processes | | | | Total number of processes |
|---|---|---|---|---|---|
| | Epsilon | Gamma | Omega | Sigma | |
| Deal with unique instances (The non-routine problem was a special case that fell outside the standard operating procedures/practices) | 1 | 3 | | 1 | 5 |
| Design internal processes (Resolving the non-routine problem required to internal practices/processes to be modified or created) | 3 | 3 | 4 | 4 | 14 |
| Develop sales business (Resolving the non-routine problem involved further development of the sales-related practices/processes) | | 4 | | | 4 |
| Optimize and automate processes (Resolving the non-routine problem required optimization/ automation of existing practices/processes) | | 3 | 3 | 3 | 9 |
| Outsourcing management (Resolving the non-routine problem required outsourcing practices/processes to be modified or developed) | 3 | 1 | | | 4 |
| Resolve technical escalation (The non-routine problem was a technical escalation; resolving the non-routine problem required investigation/development of technical and/or process-related solutions) | | | 2 | | 2 |
| Total number of processes | 7 | 14 | 9 | 8 | 38 |

## Data Analysis

The main aim of the analysis was to inductively build theory from the 38 problem-solving processes (Welch, Piekkari, Plakoyiannaki, & Paavilainen-Mäntymäki, 2011). The original focus of this study was on activities in response to non-routine problems, and was introduced as such to informants to emphasize our interest in their actions and interactions. The fact that the theoretical scope of this study was subsequently broadened to analyze the whole problem-solving process (including problem framing, solution-finding activities, searching for knowledge and scoping of solutions) helped to reduce potential concerns about respondent bias (e.g., respondents reporting on "more impactful" global non-routine problems/solutions rather than local problems/solutions so including a range of different cases).

NVivo9© was used to build and maintain a database and manage data analysis in a systematic and consistent manner. Although the data were coded manually, the software was especially useful for fragmenting and recoding the data, as well as for managing emerging codes to generate findings iteratively. We used four steps to analyze problem-solving processes:

(1) examination of micro-level activities;
(2) analysis of different patterns;
(3) examination of micro-level knowledge search;
(4) investigation of problem-solving processes in relation to the actual scope of the non-routine problems.

### *Step 1: micro-level problem-solving activities*

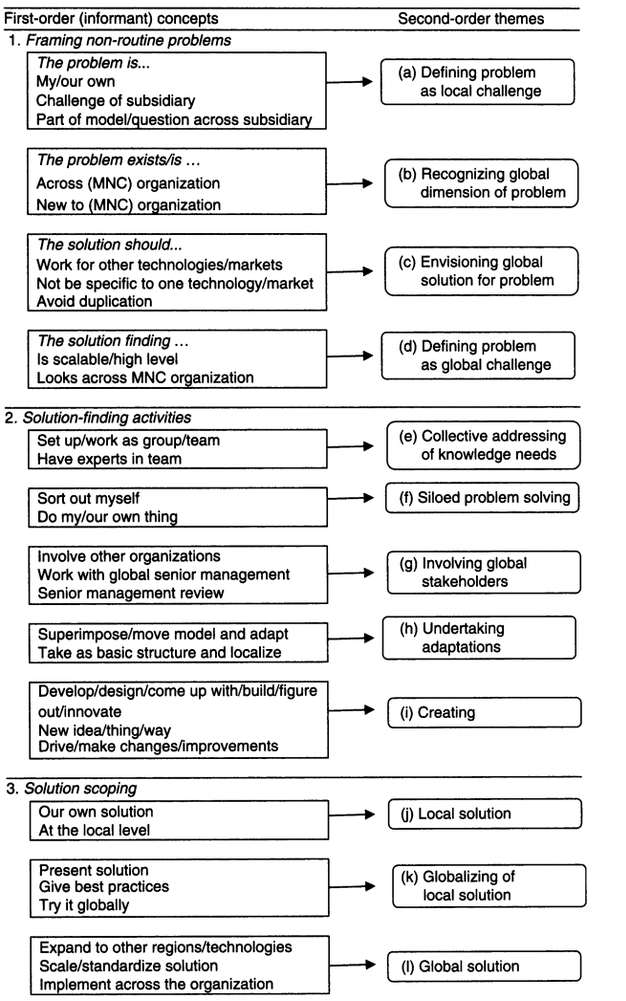
To analyze the complete problem-solving process, we broke down each process into three aspects: *framing the non-routine problem*, *solution-finding activities* and *solution scoping* – taking a micro-level focus throughout the analysis. In terms of how non-routine problems were framed, we coded all instances where the nature of the problem and envisioned solution finding was described. Then, to analyze the solution-finding activities, we

followed the empirical focus of an activity perspective, examining actual doings in the social world (Jarzabkowski, 2005; Johnson, Melin, & Whittington, 2003; Whittington, 2003), taking care to ensure we coded only specific actions and interactions rather than intentions or beliefs. In the following step, we analyzed all the instances where solution scoping – the characteristics, benefits and diffusion of the solution – were described, taking information from interview data and triangulating it wherever possible against data from senior management interviews and archives (Jick, 1979). We employed inductive qualitative techniques to develop *in vivo* codes reflecting the language the respondents used to generate a detailed representation of these data (first-order concepts), and then aggregated similar and recurring codes thematically under broader categories (second-order themes): Table 3 gives a graphical representation of these theme-building steps. Using multiple data sources to analyze solution scoping and outcomes also allowed us to draw conclusions on the relative effectiveness of each problem-solving process.

### *Step 2: different problem-solving patterns*

Our initial understanding of the data pointed towards complex patterns of problem framing, solution-finding activities and solution scoping. Step 2 of the analysis aimed to describe the interdependences between these three aspects: we examined the patterns of the occurrences and linkages of second-order themes identified in step 1 for each problem-solving process (within-case analysis), and then compared those patterns across the 38 processes (cross-case analysis). This analysis led us to identify four different *problem-solving approaches* – local template adaptation, superior technology creation, local template creation and global principle creation – the final, aggregate categories of the inductive analysis (see Table 4). Drawing on Baden-Fuller and Winter's (2007) terms – templates (*how* something is done) and principles (*why* something works) – to classify organizational-level knowledge replication strategies, we used the ideas behind their terms to describe activities during the problem-solving process. We use the word "global" loosely, incorporating various levels of international scope. As we were interested in explaining shared patterns, the analysis in Table 4 includes only the second-order themes observed in at least three processes of each problem-solving approach.

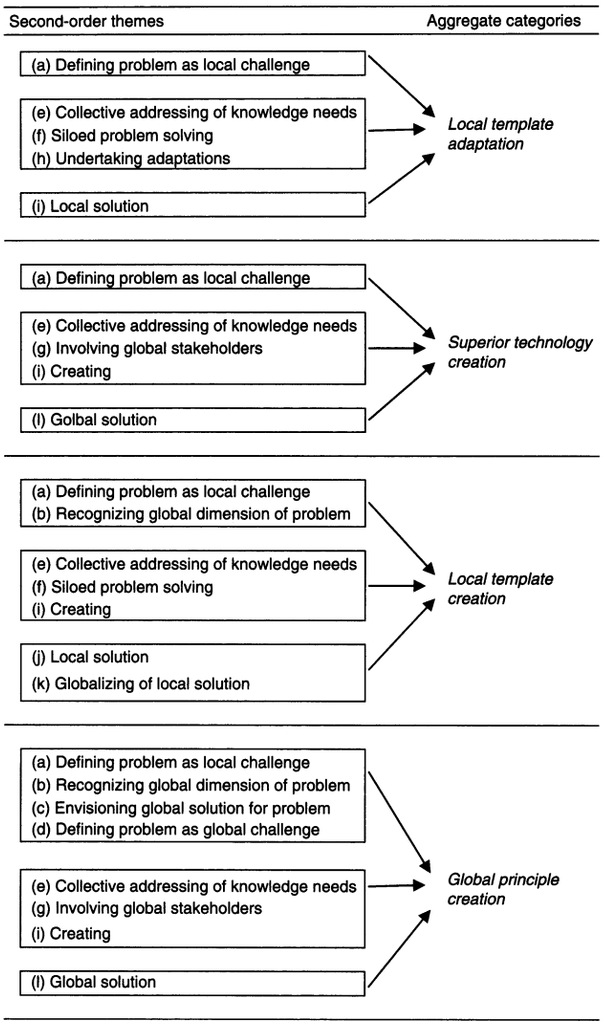
**Table 3** Progression of theme building




### *Step 3: micro-level knowledge search*

In this third step, we were interested in exploring in more detail the knowledge search actions pursued as part of the solution-finding processes. For each problem-solving process we coded all the instances of knowledge search; internal, interpersonal knowledge search instances were then coded under literature-based codes that reflected the geographic and cognitive proximity of the knowledge sources targeted (corresponding to the four boxes of Figure 1); internal knowledge located on a corporation database or intranet was coded under the "repository" category; and outside MNC knowledge sources was coded under the "external" category (see Table 5 for representative data for each of these codes). We then compared the relative frequency of these different knowledge search categories

**Table 4** Data structure




across the four problem-solving approaches and attached the labels "low," "moderate," "high" and "very high" to summarize the patterns we observed (see Tables A1–A4 in the Appendix).

### *Step 4: non-routine problem-solving process in relation to actual problem scope*

Finally, we summarized our findings in a framework, illustrated as Figure 2. The insights gained in previous analysis steps revealed that the problem-solving processes could be described in very broad terms by their local and/or global orientation of micro-level activities (shown as the vertical axis in Figure 2), while the second dimension (the horizontal axis) represents the non-routine problem's actual scope. Juxtaposing these two dimensions revealed the extent to which the solving process matched the problem's scope, which we assessed by triangulating data from the interviews and archival sources, carefully interrogating the problem explanations for references to global dimensions. Significantly, the problem might be framed as local, although the actual scope of the challenge is global (see local template creation, Figure 2), or the problem-solving process might be global although the original problem was a local one (see superior technology creation, Figure 2). Overall, the 38 problem-solving processes were distributed among the four approaches as follows: 15 (39%) illustrated the local template adaptation approach, 9 (24%) local template creation, 3 (8%) superior technology creation and 11 (29%) global principle creation.

We used a number of techniques to strengthen the trustworthiness of our qualitative research (Lincoln & Guba, 1985), including confidentiality of information, triangulation, several iterations of data analysis, constant circling between data and theory, and verification of the validity of the initial findings with respondents, incorporating their comments into the further analysis.

## FINDINGS

As noted above, our data suggested four problem-solving approaches, which we introduce in detail here, outlining the specific findings regarding the framing of the non-routine problem, micro-level solution-finding activities and knowledge search, as well as solution scoping. Table 6 presents additional data for each theme, and Table 7 a comparison of the knowledge search patterns, which are explained in detail in the following sections.

### Local Template Adaptation

This approach involves searching for a template that can be replicated to address a local non-routine problem. The basic template structure will be one that has worked effectively elsewhere, and which managers, while following how the practice was implemented at the originating unit, can blend with other, more socially embedded and context-specific knowledge to address the unit's need in implementing what is essentially a local solution.

#### *Framing the problem*

In this situation the non-routine problem is *local*: it is seen as unique to the focal unit, but may well resemble problems previously experienced by sister units. Thinking that other units or colleagues could provide a solution, the managers

**Table 5** Representative data for knowledge search

| A priori codes for knowledge search | Representative data |
|---|---|
| Geographically proximate and cognitively proximate | "Within our department there are seven of us that are line managers. And we would all have various levels of experience. So, we would meet as a group once or twice on how to do things." (Epsilon, process 6) |
| Geographically distant and cognitively proximate | "I reached out to some people, saying: do you know who does this? So you drop a few emails, send a few feelers, and I eventually got a guy who is working in Germany." (Sigma, process 4) |
| Geographically proximate and cognitively distant | "We were trying to have knowledge, for example, from one specialist team." (Gamma, process 13) |
| Geographically distant and cognitively distant | "We then also worked with the quantitative marketing team in the US. That's a highly skilled team of PhDs, statisticians, mathematicians who use mathematical models, decision-tree approaches to figure out why customers are doing what they are doing." (Gamma, process 14) |
| Repository | "It would be documented in different documents or in PowerPoint slides. ... There is no overall document which documents how the overall thing comes together. But there will be documents here, here, here, and here of each of the individual subcomponents within the overall process." (Epsilon, process 2) |
| External | "There was an Irish entrepreneur, and he had a company. They helped us develop the tool ... we [also] worked with a laser company in America. They helped us develop stronger, more powerful lasers." (Omega, process 6) |

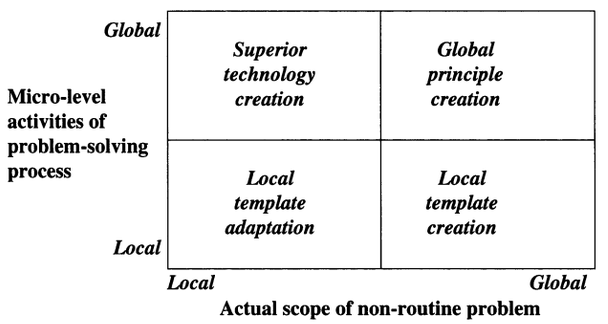



**Figure 2** Framework of MNC problem-solving approaches.

specifically frame the problems as local challenges, which is reflected in their description of how they affected the immediate units: "We were trying to get more out of lines that weren't made to be run up to that standard. ... Management knew we had huge amounts of downs" (Omega, process 2).

### *Solution-finding activities*

Local template adaptation actions typically take the form of searching for existing knowledge to solve the problem, and where it is suspected other MNC units have experienced similar situations before, managers make targeted attempts to locate existing solutions – to find knowledge templates that can be utilized. Broader knowledge searches usually cease when an apparently appropriate solution is found. Initially, managers approach their co-located peers (*high geographically proximate, cognitively proximate knowledge search*), and – if a solution template is not available locally – sometimes extend their search to peers at internationally distributed sister sites (*moderate geographically distant, cognitively proximate knowledge search*). Another solution location activity involves approaching experts (usually co-located) to access specialist expertise to supplement the solution template (*moderate geographically proximate, cognitively distant knowledge search*). Once a suitable template is located that has proven effectiveness in the context where it is found, managers aim to replicate such knowledge structures as closely as possible: "We used that, I suppose, as a basic structure" (Gamma, process 5). Despite efforts to copy closely, additional expertise from the front-line focal team is often sought to *undertake adaptations* to certain aspects of the template to respond to specific local needs: "We took ideas from them. ... We looked at how they do it [at HQ]: their template. And then we filled it with our own knowledge" (Sigma, process 2). Although

**Table 6** Additional representative data for second-order themes

| Second-order themes | Representative data |
|---|---|
| *Framing of non-routine problem* | |
| Defining problem as local challenge | "I said that we [local team] will have our own thing. We'll get lots of emergencies next year, and we'll control our own destiny." (Epsilon, process 4)<br>"This was an internal drain on our [subsidiary] resources because whether we processed 1000 of these internal messages or 100, we got no recognition because it is not the core business. It is something that supports the core business. Our productivity was how many remote services we delivered at the end of the year. So, they [senior management team of focal subsidiary] didn't care how much time we spent supporting that." (Sigma, process 5) |
| Recognizing global dimension of problem | "It [non-routine problem] is very new to Gamma." (Gamma, process 11) |
| Envisioning global solution for problem | "It is a continuous effort with other regions to link up. ... So that we just don't need to duplicate work, because we don't really believe in that." (Gamma, process 9)<br>"And we are now piloting it for our unit with a view of tracking all of our sign-offs [globally] ... This is the ultimate goal." (Sigma, process 7) |
| Defining problem as global challenge | "If you just look at one country, we will not have an analytic perspective of the issue. How does it behave, for example, in other countries or in other regions? Does it allow you to benchmark and to find patterns? Because at the end of the day, in such a global business, you want the question also to be treated globally." (Gamma, process 13) |
| *Micro-level solution-finding activities* | |
| Collective addressing of knowledge needs | "And the amount of information that is associated with each area is so vast, is so complex that we, if we talk in university terms, that you have a professor for Sociology; you have another professor for Ethnology. It's so complex and there are so many issues involved with each of these bundles of information that we need experts. ... There are people in the team who know more or some they know less about certain aspects." (Gamma, process 9) |
| Siloed problem solving | "Everyone is trying to sort out the issue as best as they can for their area." (Epsilon, process 3) |
| Involving global stakeholders | "You cannot work on your own, because there are a lot of dependencies so you actually need to have agreement from other key stakeholders and leverage them to a certain extent. ... You need to involve other stakeholders in order to have your business question sorted out." (Gamma, process 13) |
| Undertaking adaptations | "We take this model and see can we apply it to this situation? And then we adapt the model if necessary to make it the most efficient way possible." (Epsilon, process 1)<br>"There is actually a lot of material there that can be taken. It doesn't need to be created from scratch; it can be localized to the different markets." (Gamma, process 4) |
| Creating | "They [developed practices] were very new to the site; very new. And nobody was doing them at the time." (Omega, process 4)<br>"We kind of had to start pretty much from zero in developing that project which nonetheless made it also easier because we could go where we wanted." (Gamma, process 11) |
| *Scoping of solution* | |
| Local solution | "The tool that was delivered locally was about really understanding where we were spending our time, where the weak points were." (Sigma, process 5) |
| Globalizing of local solution | "We presented this exact same information to the other centers. Our Global Director, he has used this information, and now he can access it. And we have given our best practices." (Sigma, process 5) |
| Global solution | "We now expanded it out of the pilot regions into more regions. And we have started to create specialist roles and new role career paths within Gamma to do this type of work." (Gamma, process 14) |

**Table 7** Analysis of knowledge search for each role in MNC learning

| | | Local template adaptation | Superior technology creation | Local template creation | Global principle creation |
|---|---|---|---|---|---|
| Internal | | | | | |
| *Increasing innovation potential* ↓ | Geographically proximate, cognitively proximate | High | High | High | High |
| | Geographically distant, cognitively proximate | Moderate | n.a. | Low | Moderate |
| | Geographically proximate, cognitively distant | Moderate | Very high | Low | Moderate |
| | Geographically distant, cognitively distant | Low | Very high | Low | Very high |
| | Repository | Low | n.a. | Low | n.a. |
| External | | Low | Very high | Low | Low |
| Intensity | | Moderate | Very high | Low | High |

certain problem-solving processes are characterized by a collective approach, with the search for knowledge and solution finding being conducted by (often informal) teams with the help of experts' input (*collective addressing of knowledge needs*), knowledge searches still generally concentrate on local and cognitively close sources, in a *moderately intense search pattern*, with managers only *rarely searching geographically distant/cognitively distant* and/or *external knowledge sources*.

### *Solution scoping*

The adapted template becomes embedded in the focal unit's knowledge system, and interviewees often described how the solution is their (unit's) own, and works well in the focal unit (*local solution*): "I'm happy with the progress so far. ... Yes, we have come a long way" (Epsilon, process 2); "They [local senior managers] would have seen the huge decrease in downtime and they were very happy" (Omega, process 2). Echoing other work on the replication of MNC practices in subsidiaries (Becker-Ritterspach, Saka-Helmhout, & Hotho, 2010; Saka-Helmhout, 2009), this approach draws attention to the social nature of knowledge transfers, the importance of individual agency in mobilizing and enacting practices, and the link between these micro-level activities and the degree of organizational learning achieved at the subsidiary (Saka-Helmhout, 2010).

## Superior Technology Creation

The superior technology creation approach also relates to a non-routine problem of local scope. Despite this local problem scope, the problem solving is global, integrating diverse external and internal knowledge to develop a technological solution of international scope.

### *Framing the problem*

The local frame of the problem can be pinpointed, as the core technology involved – which might be quite advanced for the MNC – operates in that form only at the focal unit. One subsidiary manager recalled: "We had 100% failure. Every part was failing. ... A significant challenge. It brought the area pretty much to a halt" (Omega, process 5). Being in a subsidiary-specific situation, such problems are defined as *local challenges*.

### *Solution-finding activities*

As the problem is technologically advanced, and thus new to the global organization, the problem cannot be solved by searching for a template to replicate. Rather, it requires *creation of a new solution*, which involves design and innovation activities – "The goal is to develop this material" (Omega, process 7) – and may encompass changing existing knowledge structures (core technologies and accompanying processes) to "develop the tool and the process" (Omega, process 6). The underlying technical and operational complexities can entail multifaceted knowledge requirements, so that sourcing diverse knowledge components usually requires the coordinated efforts of a number of people – "There would be a team working on it. It's not just one person" (Omega, process 7) – collaborating as a team to *collectively address knowledge needs*.

Given the need for knowledge creation, knowledge search shows characteristics that promote innovation generation. Knowledge search typically exhibits a *very high intensity*, and focuses initially on immediate team members and management peers in order to understand the exact reasons underlying the problem, and then repeatedly consult their knowledge during solution finding

(*high geographically proximate, cognitively proximate knowledge search*). As the problems typically exhibit considerable technological complexity, it is often necessary to mobilize cognitively distant knowledge, and to search extensively for specialist expertise and skills (*very high geographically proximate, cognitively distant knowledge search*). Importantly, the geographic location of the required knowledge seems to become less important (*very high geographically distant, cognitively distant knowledge search*). In overall terms, these activities involve extensive searching for knowledge across cognitive distance, so we can characterize this knowledge search pattern as *negotiating cognitive boundaries*.

Solution development can be enhanced by drawing on specific technological knowledge held externally. A unique feature of this problem-solving approach is that additional expertise and skill are searched extensively from external organizations, both located locally and worldwide (*very high external knowledge search*), helping to create new knowledge that is globally beneficial. Our study indicates that the interdependence of the problem with external players and the specificity of the knowledge involved are what most often motivate such cognitively distant external search.

Another characteristic activity in creating superior technology is *involving global stakeholders* in the problem-solving process. Driven by a sense of urgency, and the potential the problem has for impacting business adversely, updates for global senior management on the progress of solution development are common. In addition, global senior managers and other worldwide organizations may also represent valuable knowledge sources, and be approached for their advice on the possibility and implications for developing global solutions: "They [global senior management] started to see the potential of it. ... It wasn't probably at a viable stage where it could be used for mass production. ... But we had the test runs, we proved that concept" (Omega, process 6). In that case, consulting global senior management was important, as not only did the unit receive financial support to develop a solution suited to high-volume production, but the problem-solving efforts included global management input to explore the potential for creating a global solution, and what features that might require. The involvement of global stakeholders has a triple effect, in making the corporate level aware of the subsidiary's solution-finding efforts, in securing their buy-in, and in incorporating knowledge from important global stakeholders.

### *Solution scoping*

Solutions represent innovative technological knowledge, and while the non-routine problem may only be of local scope, these problems provide the opportunity to develop new technological knowledge that is sufficiently generic and compatible to be seen as "superior" to currently used knowledge at the international level. The *global solution* that is crafted can be expanded to other technologies – "Let's qualify that on the other product lines" (Omega, process 5) – and applied in other regions: "That tool was actually used across Omega sites worldwide after it was developed" (Omega, process 6). As the superior technology is scalable, the outcomes of this approach do not just solve the initial problems, but lead to solutions that diffuse across the wider MNC, and so represent standardized solutions – "one worldwide recipe" (Omega, process 5) – that can be implemented internationally across the organization and thus achieve an "impact across a larger segment of the business" (Omega, process 7).

## Local Template Creation

In contrast to the two previous situations of local non-routine problems, the challenges here are global in scope, but problem-solving processes are nevertheless focused locally, mobilizing mainly close knowledge to develop a subsidiary-specific solution.

### *Framing the problem*

Importantly, the subsidiary managers also *recognize the global dimension of problems*. One noted explicitly: "Epsilon is a very security conscious organization. One of the challenges was in the spread of information so that the core business remains secure" (Epsilon, process 3), and another described how similar problems not only occurred in the focal unit "but across Epsilon" (Epsilon, process 7). Despite this explicit awareness, subsidiary managers nevertheless *define the problem as local challenge*, primarily addressing difficulties encountered at their focal units: "We wanted to work on the challenges that we have here" (Gamma, process 8).

### *Solution-finding activities*

Although some solution-finding efforts are organized in teams – *collectively addressing knowledge needs* – subsidiary managers generally pursue independent approaches to finding solutions (*siloed*

*problem solving*): "I would have discussed it with my manager, but it was pretty much my own idea.... If it works, we'll tell people. If not, we just learn our lesson, and we move on" (Epsilon, process 4); "We could accuse ourselves of being very much silo based, of doing our own things ... you are very much in your own head" (Epsilon, process 3). Solution finding involves only a limited number of sources in *low-intensity knowledge search*, preferring to isolate problem solving from broader inflows of diverse knowledge. Generally, few knowledge sources are targeted, and they are mainly co-located management peers or team members (*high geographically proximate, cognitively proximate knowledge search*). Only on rare occasions do knowledge searches look at more diverse locally and globally distributed knowledge sources, either internal or external to the MNC (*low geographically distant, cognitively proximate; low geographically proximate, cognitively distant; low geographically distant, cognitively distant; low external knowledge search* patterns). We can summarize these knowledge searches as generally being *trapped in local rigidities*, building primarily on the locally accumulated organizational knowledge. Knowledge thus sourced is then integrated with the managers' own expertise to *create solutions* that mostly represent new or improved processes, practices or routines – "We made improvements" (Epsilon, process 7) – that prove effective when implemented at the focal subsidiary.

### *Solution scoping*

The outcomes of this approach tend to be *local solutions*, as one respondent acknowledged explicitly: "We have innovated. ... innovation at the local level" (Sigma, process 5). In six of the nine problem-solving processes in our dataset, the solutions remained within the subsidiary units. But in the other three cases, when the MNC recognized the solution's positive performance impact, it attempted to replicate this "superior" knowledge at other units worldwide, an activity we can label *globalizing of local solutions*. This involves the subsidiary managers presenting the solution to global management peers: "We are certainly promoting the way we are doing it" (Epsilon, process 7); "We piloted it in EMEA, and I told all the other managers. ... We had informed everyone who we have in the management team [globally]" (Sigma, process 4), sharing their local "best practices" to facilitate global trials of the knowledge they had developed locally.

As the primary goal is to tackle local challenges, this approach generally neglects requirements for a solution that might have non-location-bound potential, and subsidiary managers show little understanding of why the solution they created might or might not work in other contexts. Although they are open in terms of sharing their local solution with global peers, this sharing focused on explaining *how* the exact steps of the routine are performed locally, activities that led the solution to become what we can term a *template*. This approach creates mainly location-bound, situation-specific solutions (Rugman & Verbeke, 1992, 2001), rather than proactively tackling the recognized global challenges.

## Global Principle Creation

Similar to the local template creation approach, the non-routine situation is of global scope, yet the problem-solving process is explicitly geared towards developing a global solution, mobilizing and integrating diverse knowledge to design a generic solution that is diffused within the wider MNC.

### *Framing the problem*

Problem framing in this approach involves discrete steps, which generally start by defining the problem as a *local challenge*: "I worked in one specific area in one country. But it is a key question across the [subsidiary] organization" (Gamma, process 13). When further inquiries establish that similar non-routine problems have occurred at sister units, subsidiary managers *recognize the global dimension of the problem*: "What we also see is that usually your business question is not unique to you; it is something that is not only shared, but is also happening in other places" (Gamma, process 13); "My two [Asian] peers would also be singing the same problem. So this [solution finding] was of much benefit for the group, the department in general" (Omega, process 8).

Importantly – and in contrast to the local template creation approach – when considering what kind of solution should be developed, the leading subsidiary managers consciously *envision a global solution* for the problem, which can work in other markets or technologies: "setting this out as a [globally] aligned project" (Gamma, process 9); "They [solutions] have to be backward compatible as well as forward invented" (Omega, process 9). The goal is then no longer just to develop a solution that is specific to the focal unit's problem – "It doesn't make sense for us to have something

that is just specific to that one market" (Gamma, process 14) – and which may avoid management peers developing different solutions to a similar global problem: "Those activities can be centralized into the one source. Otherwise the teams would be duplicating everything" (Gamma, process 10). In contrast to the actions typical of the local template creation approach, these managers also *define the problem as a global challenge*, and proactively take ownership of and drive the development of solutions that lead to scalable, high-level outcomes: "It is all about scale in some way. In this area, it is really about identifying a challenge, see how it is working within our remits, in my case in my countries, in my region. And then, once I have a fair understanding of it: how does it also occur in other regions? ... You can actually scale it" (Gamma, process 13); "You look from a helicopter view" (Gamma, process 12); "Everybody had to gain at the end ... this process would be a benefit to those guys [in the US], and that was the plan" (Omega, process 8). This approach actively embraces the challenges of the wider organization, rather than seek only solutions to specific local difficulties.

### *Solution-finding activities*

Managers following this approach recognize that solving global non-routine problems adds additional complexity to the solution-finding process, both in terms of the knowledge required for its development and in terms of coordinating the various local and international colleagues involved. In our cases, these complexities are usually addressed by working as a team to *collectively address knowledge needs*, distributing the different solution development components and also incorporating a range of expertise: "How can we best share best practices and work together? Because we would develop a better outcome" (Gamma, process 11); "We actually work as a group, but obviously, you can lead it" (Gamma, process 13). These collaborative actions typically involve intense searches for knowledge and expertise from the immediate team and among co-located management peers and units (*high geographically proximate, cognitively proximate knowledge search*). Specific, problem-related knowledge is also mobilized, both from other specialist subsidiary units (*moderate geographically proximate, cognitively distant knowledge search*) as well as from *global stakeholders*. Managers also tap into the relevant knowledge and expertise of global sister units, ensuring a broader collaborative effort spanning across different locations – "Ireland was the core team that made connections with the West coast [of the US, where certain global responsibilities are located]" (Omega, process 9); "What is there that other teams [worldwide] can offer? Can we collaborate?" (Gamma, process 9); "It wouldn't make sense if we work in isolation" (Gamma, process 11) – so those units that would be affected by the solution are also involved in finding and creating it.

Solution-finding activities also include obtaining investment, visibility, support and global approval of the solution idea from other global stakeholders (often brokered through immediate management): "We did get that approval [from Gamma's executive management]. So we nailed down the solutions on a very high level" (Gamma, process 11); and "Without that support it probably wouldn't happen, because it requires the interaction of different groups. So Ireland can try and drive it, but if the US aren't aligned, or if Asia aren't aligned ... you need alignment from senior management. ... It would take a lot without that support". (Omega, process 9).

Involving global stakeholders allows subsidiary managers leading solution-finding actions to demonstrate that their proactive efforts are aligned with the MNC's priorities, an important factor if they are not to be seen as merely self-interested endeavors (Birkinshaw et al., 1998: 236). This global orientation results in geographically distant knowledge searches within the same functional domain (*moderate geographically distant, cognitively proximate knowledge search*). In addition, managers' efforts to find worldwide solutions are characterized by strong attempts to locate and mobilize the most advanced and most applicable knowledge, which involves them in targeting diverse MNC expert units located anywhere worldwide (*very high geographically distant, cognitively distant knowledge search*). Such intense knowledge search across different MNC units represents an approach that *negotiates geographic distance*, and in some cases also includes external knowledge sources (*low external knowledge search*). Overall, this approach exhibits a *high-intensity knowledge search*.

### *Solution scoping*

The diverse knowledge sources are then blended to *create new solutions*, usually new or improved ways to conduct processes or practices: "There is a logistical end-to-end process design piece" (Gamma, process 12); or "It [the solution] also

involves a lot of change for Omega. It is a different supply and a different application technology" (Omega, process 9). The solution substantially modifies existing routines, or develops new ones, which are first implemented at the focal subsidiary unit, and then rolled out as *global solutions* to worldwide sister units, expanding both to other regions and across to other technologies: "We expanded it out of the pilot regions into more regions. ... We are feeding that back in the Homeland teams" (Gamma, process 14); or "It's at the stage now where we have a clean process, where we have rolled it out to all the teams" (Omega, process 8).

A certain level of standardization may be required to achieve this replication and scalability: "By keeping it in a standardized way of approaching our business, that means that we have approached that problem in all regions; it means that it also works in Homeland. ... If we had it too localized to the way how we work in EMEA, it probably wouldn't work for the Homeland team. But we kept it [the solution] pretty generic and pretty mechanic" (Gamma, process 14). It is important that actions are geared towards creating a solution around this standardized core to take account of the fact that certain country-specific or technology-specific adaptations will be needed to achieve wider relevance, and thus facilitate international scalability. More generally, in creating global solutions, the leading managers need to develop their understanding both of the nature of the local problem and of how it is manifested in other locations/technologies. In developing a solution that addresses these multiple requirements, they demonstrate how certain solutions can avoid becoming location-specific or technology-specific, and thus fulfill multiple requirements: "It's a common process [for all Omega]. And that's the way it should be" (Omega, process 8). As an understanding is developed of *why* certain solutions can work globally, which is then reflected in the kind of solutions that are developed, we can term such solutions *principles*: their outcomes not only resolve local problems, but also lead to solutions that diffuse across the wider MNC.

### *Effectiveness of problem-solving approaches*

Although this paper is concerned primarily with examining the different ways in which subsidiary managers respond to non-routine problems, and the four problem-solving approaches cannot be ranked as such, the analysis of the solutions implemented and their extent of diffusion within the wider MNC allows conclusions with regard to their relative effectiveness. First, given the urgency, downside potential and business risk of most non-routine situations, all problem-solving approaches are effective to the extent that a solution is implemented and retained that remedies the initial non-routine problem at the subsidiary level, that is, can be deemed as effective from a subsidiary viewpoint. This may involve solution creation, but also the utilization of existing MNC knowledge templates – as in the local template adaption approach, which delivers an adequate, locally effective response. Second, certain problem-solving approaches generate additional outcomes in developing solutions that diffuse beyond the focal unit (superior technology creation and global principle creation), and can thus be seen as relatively more effective from the viewpoint of the MNC than an approach whereby subsidiary managers develop local solutions to an actual global issue (local template creation). As the solutions mostly modify or develop new routines, or generate novel technology knowledge, if diffused within the wider MNC these solutions build and renew the competences of the MNC in a bottom-up manner.

## DISCUSSION

### Strategic Contribution of Subsidiaries to the MNC

A major contribution of this study is to develop theory on MNC problem solving, an increasingly important phenomenon, and, as suggested by our findings, also a process through which subsidiaries can contribute strategically to the MNC by developing solutions that renew MNC competences. Such decentralized problem solving, driven by subsidiary managers, allows the MNC to respond to its current and anticipated renewal needs. We undertook detailed qualitative work for the study, so as to be able to unravel the nuances of subsidiary managers' micro-level activities and knowledge search, as well as the outcomes of four main problem-solving approaches – local template adaption, superior technology creation, local template creation and global principle creation – as summarized in Figure 3. In the same way as previous research has observed that identifying opportunities can trigger certain subsidiary-led responses (internal, local, global, global–internal hybrid market initiatives – Birkinshaw, 1997; local-for-local or local-for-global innovation – Ghoshal, 1986), we find typical problem-solving approaches in response to the local vs global scope of non-routine

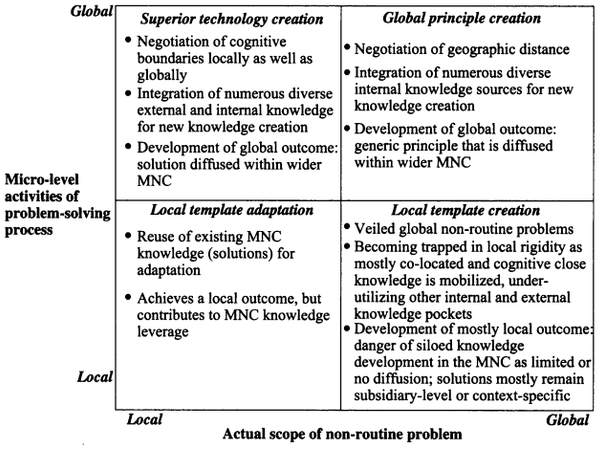



**Figure 3** Framework of MNC problem-solving approaches: summary of findings and outcomes.

problems. Identifying which activities are pursued to solve locally identified non-routine problems, and which go on to create global solutions and indeed contribute to MNC competence renewal, will be of particular interest to MNCs and IB scholars.

In the local template creation approach a global problem may be framed as local: we call such problems *veiled global*, in that, although the subsidiary managers usually became aware of the problem's true (global) scope while framing it and seeking an answer, they still approached solution finding from a local perspective. In contrast, global principle creation means not only understanding a problem's global scope, but also going on to envision and deliver a global solution. The concept of veiled global problems has important implications, as it suggests that subsidiary middle managers are often familiar with global operations and their interdependences with their own subsidiary operations, and are thus aware of the global interdependences of local challenges. There has been an assumption in the MNC literature that it is sufficient for lower-level managers to have global or transnational awareness, because actual managerial interventions relating to such interdependences are handled by their senior managers (Bartlett & Ghoshal, 1998: 246; Prahalad & Doz, 1987: 244–245). Our findings suggest, rather, that not only do subsidiary middle managers need to have such an awareness, but also that their actions and behaviors need to reflect that awareness if global interdependences are to be managed effectively.

The three problem-solving approaches – local template creation, superior technology creation and global principle creation – loosely resemble the local-for-global innovation process (Ghoshal, 1986), but again reveal previously unnoticed subtleties. While Ghoshal and colleagues suggest that local-for-global innovation is "entirely" developed at the subsidiary level and "subsequently found to be applicable in multiple locations" (Nohria & Ghoshal, 1997: 28, 29), our detailed work sheds light on the global interactions, broad knowledge searches and foresight, vision, and proactive effort that are required from early in the problem-solving process if a global impact is to be achieved (particular in the superior technology creation and global principle creation approaches). Slow or failed diffusion may be due to the resistance of other units to adopting new innovations (Kostova & Roth, 2002; Nohria & Ghoshal, 1997). Subsidiary managers try to engage peers and senior managers globally *during* the solution-finding process to anticipate and pre-empt such resistance, rather than only involve such sources later, and if an opportunity for *post hoc* leverage emerges. Indeed, the solution-finding activities of the local template creation approach show how problem-solving processes can become isolated and reliant only on subsidiary-level support, and so develop solutions that are context-specific, and which diffuse globally only with difficulty some while later (if ever).

In addition to these differences in the solution-finding actions, the two approaches to solving global non-routine problems – local template creation and global principle creation – also differed substantially from each other in terms of how subsidiary managers mobilized knowledge at the micro level. Our detailed analysis reveals that creating a local template (a context-specific solution) requires less intense and less geographically and cognitively distant knowledge search than creating a global principle – a generic, worldwide applicable solution – which requires understanding both of the various local and global dimensions of the problem and of the reasons *why* a certain solution could also work in a wider range of contexts, which (as our data show) necessitates much more intense and broader knowledge search that spans both geographic and cognitive distance. Thus not only do our results uncover important variations in the local-for-global innovation processes (local template creation, global principle creation, superior technology creation), they provide some significant clues towards answering the question of which subsidiary-driven activities are more likely to generate local or global solutions.

There are two further implications that warrant more detailed discussion. First, we found that the subsidiary managers pursue different problem-solving processes at different occasions, and also that subsidiary units may pursue multiple problem-solving approaches simultaneously. This lends additional support to our argument that micro-level managerial activities matter, and adds an important dimension to previous studies that focused more on generic processes and organizational-level contingencies.

Second, our study makes it evident that the distinction between problem-solving, initiative and innovation processes can become blurred. This is especially true for the superior technology creation and global principle creation approaches, both of which detail how non-routine problems encountered in local units, when addressed by proactive subsidiary-level efforts, can trigger solution-finding activities that lead to global outcomes. Rather than HQs perceiving these activities as "dangerous" and self-interested endeavors (Birkinshaw et al., 1998), the data show how subsidiary managers usually work collaboratively with management peers and seniors globally to create solutions that can create positive effects for their MNCs. Of course, these subsidiary managers needed to solve their local problems; but their efforts extend beyond this to build solutions that diffuse to achieve an impact within the wider corporation. These two approaches contribute, similarly to subsidiary initiatives and innovation, to enhancing MNC competences (Birkinshaw et al., 1998; Rugman & Verbeke, 2001) and promoting worldwide rather than fragmented organizational learning (Bartlett & Ghoshal, 1998; Ghoshal, 1986). Creating new solutions – where existing routines or technologies are modified, or new ones emerge – brings subtle shifts in MNCs' competences, and represent an evolutionary change that contributes to their strategic renewal.

### Micro-foundations of Knowledge Flows in MNCs

Responding to the need to further understand micro-foundations (Foss & Pedersen, 2004) and the social constitution of MNC knowledge processes (Noorderhaven & Harzing, 2009; Tallman & Chacar, 2011), the findings of this study offer important insights into how individuals deal with the challenges of geographic and cognitive boundaries that are characteristic of MNC knowledge processes, especially when innovative outcomes are desired. Building on a functional view of geographic space, where distance within MNCs is treated as a structural, organizational-level factor beyond the individual's immediate influence, geographic distance has been found to hinder MNC knowledge flows (Hansen & Løvås, 2004; Monteiro et al., 2008), leading to the problematic situation where distant search may be highly desirable for locating dissimilar knowledge to aid the generation of innovative outputs, but is hindered by the less frequent interpersonal interactions involved. Although all subsidiary managers we observed searched intensively for geographically and cognitively close knowledge (Table 7), some also actively mobilized knowledge across greater distances. Specifically, we find that local template creation approaches may be characterized by becoming *trapped in local rigidity*, mostly searching co-located and cognitively close knowledge, whereas the global principle and superior technology creation approaches usually involve *negotiating distance* to also search distantly located knowledge. This supports the notion that space in the MNC is perceived subjectively, rather than simply being an objective physical distance measure (Piscitello, 2011; Zaheer et al., 2012). Our study contributes to this emerging line of thinking in suggesting conditions for the emergence of this *far-but-close* situation (Wilson, Boyer O'Leary, Metiu, & Jett, 2008: 979): one seems to be the ability of knowledge searchers to envision a global and innovative purpose for their search outcomes (broadening the solution space); another a strong perception that solution-relevant knowledge exists, and can be explored through interpersonal exchanges. These conditions seem to lead to a subjectively constructed feeling of closeness that enables the mobilization of cognitively and geographically distant knowledge.

### Implications for Practice

The value added by solutions generated in subsidiaries cannot be underestimated. How subsidiary managers drive problem-solving processes deserves acknowledgement: the global principle/superior technology creation approaches, in particular, move beyond just tackling local problems to creating global solutions. Achieving global solutions poses high demands on the problem-solving processes. Although empirical examinations of the reasons behind this behavior are beyond the scope of this paper, it is likely that, even when a problem is recognized as having a global dimension, operational performance pressures may often point

solution-finding efforts more towards immediate solutions than towards exploring global possibilities. Interactive global problem solving requires a longer-term perspective, intense and wide knowledge search, and the involvement of global stakeholders: it takes time and creates costs. Subsidiary managers' workload will need to be managed to allow them to dedicate the necessary time and other resources, and their evaluation criteria may need to expand to include notions of contributing to the wider group/line of business if their interest in acting interdependently and beyond their immediate subsidiary is to be fostered.

Our findings reveal that creating a global solution involves holistic engagement, and building relationships with management peers, senior management and other expert units globally. This is a critical element in a subsidiary's ability to exchange knowledge and develop strategic importance (Gnyawali, Singal, & Mu, 2009), and engaging with global management is a channel through which a subsidiary's voice may be heard (Bouquet & Birkinshaw, 2008) and HQ can engage in subsidiary innovation processes (Ciabuschi, Forsgren, & Martin, 2011). From a subsidiary perspective, to fully appreciate the benefits of globally oriented solution finding means recognizing these positive, longer-term networking and profile-building effects. Also, subsidiary managers need to be aware that the way a problem is framed can influence solution-finding activities: the global scope of the non-routine problem may help to "negotiate distance," but a local scope does not mean that solution findings must inevitably be "trapped in local rigidities." Searches may be biased towards a local focus, but managers can overcome possible negative effects by remaining open to the idea of tapping into MNC-wide knowledge pockets.

### Limitations and Implications for Future Research

As with all exploratory research, further studies are needed to establish the generalizability of our findings, but we expect they will have broader relevance. First, the phenomenon under investigation – subsidiary-driven problem-solving processes – is very likely mirrored in other industries, more frequently in sectors with moderate and high environmental dynamism. Second, all subsidiary managers need to deal with the dispersion of knowledge, a basic attribute of any MNC, which implies that the nature of the challenges to knowledge search is the same, and might lead to similar response patterns (being trapped in local rigidities vs negotiating geographic and cognitive distance). Third, our replication research design allowed us to extend theory by taking account of a range of different aspects at MNC, subsidiary and middle management level (see Table 1 and research design section), which strengthens our emergent insights.

A potential limitation of this study is that subsidiary managers could nominate the non-routine problem. Although the urgency and downside potential of most non-routine problems require that a solution be implemented, and measures were taken to mitigate bias, we cannot fully rule out success bias in that managers chose to talk about problems that they resolved successfully at the subsidiary level. In addition, in the situations where local solutions were found to global non-routine problems, our data do not permit us to determine exactly when the global problem dimension was noticed (before, during or after the solution was found). However, we do not believe this influences our conclusions, because our findings indicate that searching broadly is also important to finding solutions to local problems, as it will help to determine the scope of the challenge more accurately and reformulate the problem, where meaningful, in more multi-dimensional ways (Cross & Sproull, 2004).

This research shows the strategic role that subsidiaries can play in driving global solution development, and suggests the value of pursuing this research agenda further. Our unit of analysis was the problem-solving process and our empirical interest in micro-level activities; further research could adopt a multilevel research design to examine the impact of MNC governance mechanisms (Foss, Husted, & Michailova, 2010). We sampled subsidiary managers rather than problem-solving networks, but it also seems worthwhile to investigate the influence of social networks on problem-solving efficiency and effectiveness in more detail. More explorative work is also required to uncover how subsidiary managers actually sell their ideas and local solutions to global managers, and the managerial competences that such actions require (Rouleau & Balogun, 2011).

We observed that problem-solving approaches involve sharing not only final solutions (local template creation), but also solution ideas (global principle creation, superior technology creation). Further research might explore whether these different approaches attract different levels of headquarter attention (Bouquet, Morrison, &

Birkinshaw, 2009), which can be a critical factor in developing the subsidiary's influence *vis-à-vis* peer units (Ambos et al., 2010). The significance of problem framing for how problem-solving processes unfold means that we also need to understand more about how subsidiary managers make sense of challenges, and formulate relevant solution spaces. The affective element of problem formulation (Lyles & Mitroff, 1980) means that individuals may frame their local solution space for reasons such as problem avoidance, fear, political and internal competition: again, these aspects call for further exploration.

## CONCLUSION

Examining non-routine problem solving broadens our perspective on the various ways in which subsidiaries can contribute strategically to MNCs. We have argued that all subsidiary units regularly encounter non-routine problems, and the ability of the MNC to mobilize its managers to pursue effective problem-solving approaches is important in ensuring the continuous renewal of MNC competences. This study represents a further step in understanding problem solving in the MNC by explicating four problem-solving approaches – local template adaptation, superior technology creation, local template creation and global principle creation – and their micro-level dynamics and outcomes.

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## NOTES

[1]The terms "non-routine problem solving" and "problem solving" are used interchangeably for reasons of parsimony. This paper is concerned with problem solving as a response to non-routine events rather than other forms such as new product development or innovation management.

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# APPENDIX

**Table A1** Knowledge search of local template adaptation approach

| No. | Process | Intensity | Distance analysis (in brackets: number of occurrences if more than one) |
|---|---|---|---|
| 1 | Gamma, process 1 | 3 | Geographically proximate, cognitively proximate<br>Geographically proximate, cognitively distant<br>Repository |
| 2 | Gamma, process 2 | 2 | Geographically proximate, cognitively proximate (2) |
| 3 | Gamma, process 3 | 2 | Geographically proximate, cognitively distant<br>External |
| 4 | Gamma, process 4 | 2 | Geographically proximate, cognitively proximate<br>Geographically proximate, cognitively distant |
| 5 | Gamma, process 5 | 2 | Geographic proximate, cognitively proximate<br>Geographically distant, cognitively distant |
| 6 | Gamma, process 6 | 2 | Geographically proximate, cognitively proximate<br>Geographically proximate, cognitively distant |
| 7 | Gamma, process 7 | 2 | Geographically distant, cognitively proximate (2) |
| 8 | Epsilon, process 1 | 1 | Geographically distant, cognitively proximate |
| 9 | Epsilon, process 2 | 4 | Geographically proximate, cognitively proximate<br>Geographically proximate, cognitively distant (2)<br>Repository |
| 10 | Omega, process 1 | 4 | Geographically proximate, cognitively proximate (2)<br>Geographically distant, cognitively proximate<br>Geographically proximate, cognitively distance |
| 11 | Omega, process 2 | 2 | Geographically proximate, cognitively proximate<br>Geographically distant, cognitively proximate |
| 12 | Omega, process 3 | 1 | Geographically distant, cognitively proximate |
| 13 | Sigma, process 1 | 1 | Geographically proximate, cognitively distant |
| 14 | Sigma, process 2 | 5 | Geographically proximate, cognitively proximate<br>Geographically distant, cognitively proximate<br>Geographically distant, cognitively distant<br>Repository<br>External |
| 15 | Sigma, process 3 | 3 | Geographically distant, cognitively proximate<br>Geographically distant, cognitively distant<br>Geographically proximate, cognitively proximate |
| | | Average intensity:[a]<br>2.4 (moderate) | Relative frequency:[b]<br>Geographically proximate, cognitively proximate: 0.80 (high)<br>Geographically distant, cognitively proximate: 0.47 (moderate)<br>Geographically proximate, cognitively distant: 0.60 (moderate)<br>Geographically distant, cognitively distant: 0.20 (low)<br>Repository: 0.20 (low)<br>External: 0.13 (low) |

[a]The average intensity was labeled "low" if smaller than 2, "moderate" if between 2 and 4, "high" if between 4 and 6, and "very high" if greater than 6.
[b]The relative frequency was labeled "low" if smaller than or equal to 0.33, "moderate" if in the range 0.34–0.66, "high" if in the range 0.67–1, and "very high" if greater than 1.

**Table A2** Knowledge search of local template creation approach

| No. | Process | Intensity | Distance analysis (in brackets: number of occurrences if more than one) |
|---|---|---|---|
| 16 | Gamma, process 8 | 2 | Geographically proximate, cognitively proximate<br>Geographically proximate, cognitively distant |
| 17 | Epsilon, process 3 | 2 | Geographically proximate, cognitively proximate (2) |
| 18 | Epsilon, process 4 | 0 | n.a. |
| 19 | Epsilon, process 5 | 4 | Geographically distant, cognitively proximate<br>Repository<br>External (2) |
| 20 | Epsilon, process 6 | 2 | External<br>Geographically proximate, cognitively proximate |
| 21 | Epsilon, process 7 | 1 | Geographically proximate, cognitively proximate |
| 22 | Omega, process 4 | 1 | Geographically proximate, cognitively proximate |
| 23 | Sigma, process 4 | 3 | Geographically proximate, cognitively distant<br>Geographically distant, cognitively distant (2) |
| 24 | Sigma, process 5 | 1 | Geographically proximate, cognitively proximate |
| | | Average intensity:[a]<br>1.8 (low) | Relative frequency:[b]<br>Geographic proximate, cognitively proximate: 0.78 (high)<br>Geographic distant, cognitively proximate: 0.11 (low)<br>Geographic proximate, cognitively distant: 0.22 (low)<br>Geographic distant, cognitively distant: 0.22 (low)<br>Repository: 0.11 (low)<br>External: 0.33 (low) |

[a]The average intensity was labeled "low" if smaller than 2, "moderate" if between 2 and 4, "high" if between 4 and 6, and "very high" if greater than 6.
[b]The relative frequency was labeled "low" if smaller or equal to 0.33, "moderate" if in the range 0.34–0.66, "high" if in the range 0.67–1, and "very high" if greater than 1.

**Table A3** Knowledge search of superior technology creation approach

| No. | Process | Intensity | Distance analysis (in brackets: number of occurrences if more than one) |
|---|---|---|---|
| 25 | Omega, process 5 | 8 | Geographically proximate, cognitively proximate<br>Geographically proximate, cognitively distant (3)<br>Geographically distant, cognitively distant<br>External (3) |
| 26 | Omega, process 6 | 6 | Geographically proximate, cognitively proximate (2)<br>Geographically proximate, cognitively distant (2)<br>External (2) |
| 27 | Omega, process 7 | 9 | Geographically proximate, cognitively proximate<br>Geographically proximate, cognitively distant (3)<br>Geographically distant, cognitively distant (2)<br>External (3) |
| | | Average intensity:[a]<br>7.5 (very high) | Relative frequency:[b]<br>Geographically proximate, cognitively proximate: 1.33 (very high)<br>Geographically distant, cognitively proximate: 0 (n.a.)<br>Geographically proximate, cognitively distant: 2.67 (very high)<br>Geographically distant, cognitively distant: 1.00 (high)<br>Repository: 0 (n.a.)<br>External: 2.67 (very high) |

[a]The average intensity was labeled "low" if smaller than 2, "moderate" if between 2 and 4, "high" if between 4 and 6, and "very high" if greater than 6.
[b]The relative frequency was labeled "low" if smaller or equal to 0.33, "moderate" if in the range 0.34–0.66, "high" if in the range 0.67–1, and "very high" if greater than 1.

**Table A4** Knowledge search of global principle creation approach

| No. | Process | Intensity | Distance analysis (in brackets: number of occurrences if more than one) |
|---|---|---|---|
| 28 | Gamma, process 9 | 5 | Geographically proximate, cognitively proximate (2)<br>Geographically distant, cognitively proximate<br>Geographically distant, cognitively distant (2) |
| 29 | Gamma, process 10 | 2 | Geographically distant, cognitively distant (2) |
| 30 | Gamma, process 11 | 7 | Geographically proximate, cognitively proximate<br>Geographically distant, cognitively distant (4)<br>External (2) |
| 31 | Gamma, process 12 | 5 | Geographically proximate, cognitively proximate (3)<br>Geographically proximate, cognitively distant<br>Geographically distant, cognitively distant |
| 32 | Gamma, process 13 | 5 | Geographically proximate, cognitively proximate (2)<br>Geographically distant, cognitively proximate<br>Geographically proximate, cognitively distant<br>Geographically distant, cognitively distant |
| 33 | Gamma, process 14 | 6 | Geographically proximate, cognitively proximate (2)<br>Geographically proximate, cognitively distant (3)<br>Geographically distant, cognitively distant |
| 34 | Sigma, process 6 | 2 | Geographically distant, cognitively proximate (2) |
| 35 | Sigma, process 7 | 4 | Geographically distant, cognitively distant (4) |
| 36 | Sigma, process 8 | 3 | Geographically distant, cognitively proximate (2)<br>Geographically distant, cognitively distant |
| 37 | Omega, process 8 | 2 | Geographically distant, cognitively proximate<br>Geographically proximate, cognitively distance |
| 38 | Omega, process 9 | 3 | Geographically proximate, cognitively proximate<br>Geographically distant, cognitively distant<br>External |
| | | Average intensity:[a]<br>4.0 (high) | Relative frequency:[b]<br>Geographically proximate, cognitively proximate: 1.00 (high)<br>Geographically distant, cognitively proximate: 0.64 (moderate)<br>Geographically proximate, cognitively distant: 0.55 (moderate)<br>Geographically distant, cognitively distant: 1.55 (very high)<br>Repository: 0 (n.a.)<br>External: 0.27 (low) |

[a]The average intensity was labeled "low" if smaller than 2, "moderate" if between 2 and 4, "high" if between 4 and 6, and "very high" if greater than 6.
[b]The relative frequency was labeled "low" if smaller or equal to 0.33, "moderate" if in the range 0.34–0.66, "high" if in the range 0.67–1, and "very high" if greater than 1.

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