VTT Technical Research Centre of Finland

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Published in:
Technology Analysis and Strategic Management

DOI:
10.1080/09537325.2017.1297398

Published: 01/01/2018

Document Version
Peer reviewed version

Pihlajamaa, M. (2018). Absorbing radical ideas from unusual sources–the role of social integration mechanisms. Technology Analysis & Strategic Management, 30(2), 131-143.

https://doi.org/10.1080/09537325.2017.1297398

Absorbing radical ideas from unusual sources – the role of social integration mechanisms

Abstract

If companies rely strongly on internal R&D and existing networks their ability to introduce radical innovations may suffer. Opening up to new idea sources may provide a solution. Incumbent companies, however, often suffer from the tendency to reject radical ideas from unusual sources. This study investigates how social integration mechanisms (coordination, socialisation, and systems mechanisms) influence an incumbent steel company's absorptive capacity (AC). A micro-level analysis of two radical ideas from unusual sources contributes to AC and radical innovation literatures by exploring relationships between social integration mechanisms and four AC capabilities (acquisition, assimilation, transformation, and exploitation). The findings suggest that AC capabilities are context specific with respect to innovation novelty and idea source. The results emphasize the negative sides of socialisation and formalisation mechanisms, and the positive effects of coordination mechanisms on the AC capabilities in such high uncertainty contexts.

Keywords: absorptive capacity; radical innovation; technology & innovation studies; case study

1. Introduction

The ability to acquire and develop radical ideas is an important antecedent of radical innovation (Frishammar et al. 2016) and competitive advantage (O'Connor 2008). The external networks that incumbent companies interact with are, however, often tightly integrated and inwardly focused so that they perform well in diffusing existing knowledge but are poorly suitable for the exploration of new perspectives (Birkinshaw, Bessant, and Delbridge 2007; Chang et al. 2012; Stringer 2000). Not only are the companies not looking for ideas from new sources – if such ideas come across, they may be unable to benefit from them (Katz and Allen 1982). Radical ideas are highly uncertain and if they originate from unusual sources they are perceived as even more risky and are often rejected (Chesbrough 2006).

Organizations with high absorptive capacity (AC), i.e. the ability to 'recognize the value of new, external information, assimilate it, and apply it to commercial ends' (Cohen and Levinthal 1990, 128), can reach higher innovation performance (Volberda, Foss, and Lyles 2010) and introduce more radical innovations (Enkel and Heil 2014; Forés and Camisón 2016; Ritala and Hurmelinna-Laukkanen 2013). AC literature suggests that the ability to benefit from new ideas can be studied by looking at social integration mechanisms (SIMs) which facilitate intraorganizational knowledge sharing and exploitation (Jansen, Bosch, and Volberda 2005). This study analyses two projects in an incumbent global steel company and investigates how SIMs influence the absorption of radical ideas from unusual sources.

2. Theoretical background

2.1 Radical ideas and innovations

Radical innovations are here defined as products, services, or processes which encompass novel technologies or require new market structures, and have the potential to create paradigm shifts at the level of the world, the market, or the industry (Garcia and Calantone 2002). Such innovations entail significant financial rewards (Kyriakopoulos, Hughes, and Hughes 2015), customer benefits (Sorescu, Chandy, and Prabhu 2003), and competitive advantages (O'Connor 2008). Incumbent companies, however, typically have organizational inhibitors which limit their search for new ideas and filter out risky propositions despite of their potential (Bessant et al. 2005; Chang et al. 2012). Radical ideas are highly original and creative, challenge established practices, roles, interests, and power structures within organizations (Sijbom et al. 2014), and may require new cognitive frames (Bessant et al. 2014). If they are evaluated from existing cognitive frames they are easy to reject based on high uncertainties (O'Connor and Rice 2013).

Extant research suggests that standard procedures for developing ideas are not useful for radical ideas (Robbins and O'Corman 2014). Efficiency-oriented stage-gate systems (Bessant et al. 2014) and conventional market research (Frishammar et al. 2016) may be unsuitable because of nonlinear development trajectories (Robbins and O'Corman 2015) and unknown ultimate uses and markets (O'Connor and Rice 2013). Instead, they may benefit from iterative experimentations (Chang et al. 2012) and cross-functional collaboration (Stringer 2000). Formal control may be detrimental for radical ideas (Chiesa et al. 2009), and championing individuals and teams should be given high autonomy (Chiu et al. 2016) to develop them in a bottom-up fashion (Reid and de Brentani 2004). Sometimes projects may proceed in secret without official project status, resources, or managerial attention (Reid and de Brentani 2004).

Incumbent companies often rely strongly on internal R&D and existing external networks (Birkinshaw, Bessant, and Delbridge 2007; Chang et al. 2012; Stringer 2000). Radical innovation, however, may benefit from new contacts: developing peripheral vision (Day and Schoemaker 2004) and weak ties (Phillips et al. 2006), reaching out beyond current relationships (O'Connor and McDermott 2004), combination over multiple knowledge domains (Schoenmakers and Duysters 2010), increasing search breadth (Cai, Smart, and Liu 2014), and linkages with heterogeneous populations (Bessant et al. 2005). Collaboration with entrepreneurs (Chandy and Tellis 2000), employees (Kesting and Ulhøi 2010), users (Abrell et al. 2016), and other industries (Datta and Jessup 2013) may generate radical ideas. Ideas from unusual sources can, however, be perceived as highly risky (Chesbrough 2006). Since radical ideas are uncertain to start with, R&D teams may reject radical ideas from unusual sources (Burcharth, Knudsen, and Søndergaard 2014; Katz and Allen 1982).

2.2 Absorptive capacity and social integration mechanisms

According to Zahra and George (2002), AC is comprised of four organizational capabilities: acquisition, assimilation, transformation, and exploitation. Acquisition considers identifying and gaining access to externally generated knowledge. Assimilation denotes the capability to analyse, process, interpret, and understand new knowledge. Transformation refers to how the new knowledge is combined with existing knowledge. Finally, exploitation stands for the incorporation of the new knowledge in the company's operations. Todorova and Durisin (2007) argue that assimilation and transformation should be considered as alternatives in the absorption process (see Figure 1). If new knowledge fits into existing cognitive structures well enough, it can be assimilated into them. Transformation takes place when new cognitive structures have to be built via combination.

The level of AC has been linked to prior related knowledge (Cohen and Levinthal 1990) and the compatibility between the parties of knowledge transfer (Lane and Lubatkin, 1998). Additionally, SIMs which facilitate the integration of knowledge, have been noted as antecedents of AC. Well-working mechanisms are needed to overcome barriers in knowledge exchange by facilitating interactions and information flows (Zahra and George, 2002). Van den Bosch, Volberda, and de Boer (1999) divide SIMs into three categories: socialisation mechanisms, coordination mechanisms, and systems mechanisms. Table 1 reviews extant studies on SIMs.

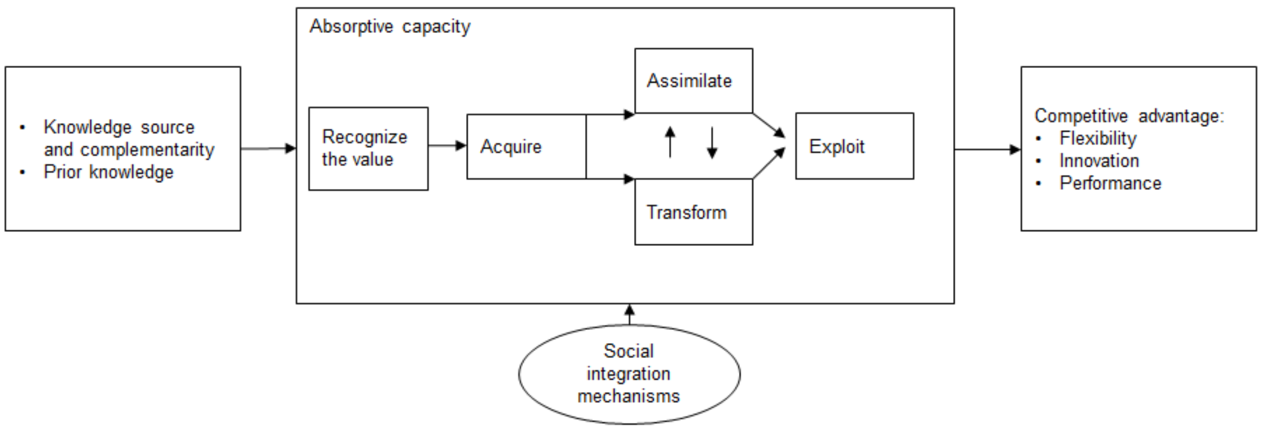

Figure 1. A model of AC. Modified from Todorova and Durisin (2007, 776).

Socialisation mechanisms facilitate the creation of common codes of communication and reduce conflicting goals by specifying tacit rules for appropriate action and structuring social experiences (Jansen, Bosch, and Volberda 2005). Teaching new employees unit-specific languages, values, beliefs, and norms creates strong links between them which facilitates communication and comprehension. Connectedness, i.e. the density of networks, is noted to govern interactions within the organization (Jansen, Bosch, and Volberda 2005). Strong and extensive ties within a specific group promote trust, improve cooperation, and facilitate knowledge exchange (Ebers and Maurer 2014; Jansen, Bosch, and Volberda 2005; Todorova and Durisin 2007). Despite of their benefits, socialisation mechanisms may sometimes inhibit AC as they increase reliance on a specific set of knowledge sources which may result in myopia and inertia due to ‘group think’ (Jansen, Bosch, and Volberda 2005; Van Lancker et al. 2016).

C*oordination mechanisms* facilitate knowledge transfer across disciplinary, hierarchical, and functional borders and ensure that individuals with various backgrounds and expertise are connected (Jansen, Bosch, and Volberda 2005). They help integrate new knowledge into existing knowledge bases, create shared interpretations of problems, and overcome differences. Well-connected and socially adept individuals are important in linking acquired and assimilated knowledge to those who can transform and exploit it (Ebers and Maurer 2014; Jones 2006; Tortoriello 2015). Gatekeepers, boundary spanners, and change agents may promote formal and informal communication across and within companies and drive changes at the levels of organization, routines, and strategy (Jones 2006).

Finally, *systems mechanisms* such as manuals, policies, and procedures are formal and explicit methods to control organizational behaviour. They provide organizational memory for handling recurring events, establish patterns of organizational action (Jansen, Bosch, and Volberda 2005), facilitate knowledge flows, and maintain a consistent view of the firm's knowledge base (Cepeda-Carrion, Cegarra-Navarro, and Jimenez-Jimenez 2012; Jansen, Bosch, and Volberda 2005; Roberts 2015). Systems mechanisms may have their downsides as codified rules may not allow changes of plans when new unexpected ideas or events arise (Jansen, Bosch, and Volberda 2005).

AC has been identified to promote radical innovation (Enkel and Heil 2014; Forés and Camisón 2016; Ritala and Hurmelinna-Laukkanen 2013) but differences between the absorption processes of radical and incremental ideas have remained uncharted. Furthermore, the field has mostly ignored intraorganizational factors at the level of individuals and groups (Easterby-Smith et al. 2008; Lane, Koka, and Pathak 2006; Martinkenaite and Breunig 2016; Volberda, Foss, and Lyles 2010), which this study addresses.

Table 1: SIMs in the AC literature

Category	Mechanism	AC capability
Socialisation mechanisms	Connectedness (Jansen, Bosch, and Volberda 2005)	Assimilation, transformation, exploitation
	Connectedness (Roberts 2015; Todorova and Durisin 2007)	Acquisition, assimilation, transformation, exploitation
	Social networks (Todorova and Durisin 2007)	Acquisition, assimilation, transformation, exploitation
	Social networks (Zahra and George 2002)	Assimilation, transformation
	Trust and strong ties (Ebers and Maurer 2014)	Acquisition, assimilation, transformation, exploitation
	Shared values and norms (Lewin, Massini, and Peeters 2010)	Acquisition, assimilation, transformation, exploitation
	Unit-specific language, values, and beliefs (Jansen, Bosch, and Volberda 2005)	Transformation, exploitation
Coordination mechanisms	Formal SIMs, e.g. organizational structures, coordinators (Zahra and George 2002)	Assimilation, transformation
	Structures and routines for knowledge transfer (Matusik and Heeley 2005)	Acquisition, assimilation
	Informal hall talk, cross-functional communication (Roberts 2015)	Not defined
	Cross-functional interfaces and job rotation (Jansen, Bosch, and Volberda 2005)	Acquisition, assimilation, transformation
	Participation in decision making (Jansen, Bosch, and Volberda 2005)	Acquisition, transformation
	Relational learning (e.g. knowledge sharing routines, joint teams, face-to -face meetings) (Leal-Rodríguez et al. 2014)	Linking potential AC (acquisition, assimilation) and realised AC (transformation, exploitation)
	Cross-functional interactions, participatory leadership (Hotho, Becker-Ritterspach, and Saka-Helmhout 2012)	Not defined
	Boundary spanners (Ebers and Maurer 2014)	Acquisition, assimilation, transformation, exploitation
	Boundary spanners (Tortoriello 2015)	Not defined
	Gatekeepers and boundary spanners (Jones 2006)	Acquisition, assimilation
	Change agents (Jones 2006)	Transformation, exploitation
Systems mechanisms	Formalisation (Jansen, Bosch, and Volberda 2005)	Transformation, exploitation
	Routinisation (Jansen, Bosch, and Volberda 2005)	(Negative effects) acquisition, assimilation, transformation
	Data integration (Roberts 2015)	Acquisition, assimilation, transformation, exploitation
	Information systems capabilities (Cepeda-Carrion, Cegarra-Navarro, and Jimenez-Jimenez 2012)	Linking potential AC and realised AC

3. Methodology and data

Case study methodology is adopted as it is suitable for acquiring rich data and for identifying emerging themes and patterns (Eisenhardt and Graebner 2007). Single case design is appropriate if the case represents extreme or unique circumstances or is exceptionally revelatory

(Yin 2003). The case should be selected based on theoretical fit with the studied topic (Eisenhardt and Graebner 2007). This study investigates a global steel company, referred to as *Steel Inc.* The company has a steady market position, a successful track record in introducing incremental innovations, and some experience in developing radical ideas into innovative products and processes.

Steel Inc. is chosen for several reasons. First, it is an incumbent company interested in developing radical innovations, which allows investigation of tensions between core capabilities and renewal (Leonard-Barton 1992). Second, it provided access to two radical innovation projects originating from unusual idea sources enabling the investigation of a novel context. Third, the case comprises one successful and one failed project which diminishes survivorship bias from focusing only on success stories. Fourth, the industry context is considered to be challenging for the development of radical innovations. Studying such extreme circumstances is likely to provide novel insights (Yin 2003).

Semi-structured interviews with involved employees and the inventors are the main data source. In selecting the interviewees, the first step was to ask a senior R&D Director to identify relevant employees. The initial sample was complemented with snowball sampling (Patton 2014). The interview guide covered the ideas' journeys and mechanisms that promoted or inhibited their development. Additional interviews were conducted on the company's innovation management system for providing context and identifying special characteristics of the two projects. The word 'project' is here used in a broad sense including events that occurred both before and after official project statuses were granted for the development of the ideas.

Total of 21 interviews, 1–2 hours each, were conducted, recorded, and transcribed verbatim (Table 2). At least two researchers participated in all interviews. To protect the confidentiality and anonymity of the informants and ensure access to data, the research team signed non-disclosure agreements (NDA) with the organization and used a pseudonym for its name (Bell and Bryman 2007). The company also provided access to additional data (total amount of ~100 sheets) including internal memos and e-mail correspondence related to the projects, innovation process diagrams, and organizational charts.

Table 2: Interviewee profiles

Project 1 (7)	**Project 2 (6)**	**General interviews (8)**
Engineer (Inventor) R&D Manager R&D Director R&D Director R&D Manager Product Manager R&D Manager	Entrepreneur (Inventor) Technology Director Specialist R&D Manager R&D Director R&D Director	Research Director Research Manager Technology Director Application Manager Vice President R&D Director R&D Manager Director, Business Model Development

The projects were first analysed individually. Project descriptions were written to create coherent representations of the chains of events. Interview transcripts and relevant documents were coded using the Atlas.ti computer programme. At first, the data was coded inductively in a data-driven fashion to identify events, actions, and their outcomes in the idea journeys and the interviewees' explanations of their driving forces and inhibitors.

Table 3: Indicators, key project elements, and illustrative quotations of AC capabilities

Indicators proposed in the literature	**Key elements in the case projects**	**Illustrative quotations**
Aquisition		
- Ability to detect opportunities in the environment (Noblet, Simon and Parent 2011) - Detailed observation of external sources of new technologies (Lichtenthaler 2009) - Effective routines to identify, value, and import new knowledge (Roberts 2015) - Management that actively seeks innovative ideas (Cepeda-Carrion, Cegarra-Navarro and Jimenez-Jimenez 2012)	- Gaining access to radical ideas from different sources. - Managerial interest in radical ideas at different hierarchical levels. - Recognizing the initial value of radical ideas.	'Our CEO received a letter from the inventor and took the idea seriously from the very beginning. He then sent a couple of specialists to visit him and discuss potential collaboration.' (indicates high acquisition capability)
Assimilation		

- Ability to quickly understand new opportunities to serve clients (Jansen, Bosch, and Volberda 2005) - Ability to use employees' knowledge, experience and competency in the interpretation of new knowledge (Forés and Camison 2016) - Capability to assimilate new technologies and innovations that are useful or have proven potential (Forés and Camisón 2016)	- Investigating technological and commercial aspects of the idea. - Conducting manufacturing tests. - Leveraging relevant knowledge, experience and competency in understanding the idea.	'We had to conduct the first manufacturing test in secret because we couldn't get a permission for it. Others explicitly opposed the idea: if it was possible someone else would have invented it already.' (indicates low assimilation capability)
Transformation		
- Ability to challenge established thinking or practices (Noblet, Simon and Parent 2011) - Ability to understand the consequences of changing market demands in terms of new products and services (Jansen et al., 2005; Leal-Rodríguez et al. 2014) - Firm's capability to adapt technologies designed by others to its particular needs (Forés and Camisón 2016)	- Rethinking the company's scope. - Finding new application areas.	'After we acquired hard proof from the first manufacturing tests, things started slowly progressing, but even then we struggled to do more tests. When we found the first customers, we still had to fight to get money for the needed investments. To put it bluntly, we wasted a lot of time by arguing with each other.' (indicates low transformation capability)
Exploitation		
- Ability to apply and implement technologies in new products (Lichtenthaler 2009) - Application of the assimilated external knowledge (Noblet, Simon, and Parent 2011) - Capability to put technological knowledge into product and process patents (Forés and Camisón 2016) - Capability to use and exploit new knowledge in the workplace to respond quickly to environment changes (Forés and Camisón 2016)	- Introducing new products. - New market creation - Initiating operations.	'We realised that we can also make new kinds of products with the new process. We started to systematically look for markets for a new type of steel. This required close collaboration with sales, marketing, and technical support teams. There was not much domestic demand so we put effort to market the new products globally.' (indicates high exploitation capability)

Studies on AC capabilities were investigated to generate a list of indicators which suggest high capability levels. These indicators helped operationalize the capabilities and identify elements in the projects that could be used to evaluate AC performance (Table 3). AC levels were assessed by looking for comments which indicate high/low success in key elements associated with each capability. If there was a balance of positive and negative assessments of a capability the level was considered to be medium.

Similarly, extant studies on SIMs (Table 1) guided the analysis by providing lists of relevant SIMs for identifying and categorizing mechanisms from the projects (Table 4). Typically, mentions of SIMs appeared in relation to key capability elements which made possible to link SIMs and AC capabilities together (Table 7). The codes and categorisations were constantly compared to the data to ensure their consistency. Finally, the projects were compared by arranging them into tables and matching the identified patterns. Key informants were met several times to discuss emerging findings and confirm their validity. Comparability of the findings is supported by the inclusion of the general interviews and documents, which enable triangulation among different data at the project and organizational levels (Miles and Huberman 1994).

Table 4: Examples of identified SIMs with illustrative quotations

SIM	Category	Illustrative quotations
Shared language, background, and education	Socialisation mechanisms	'Those who tinker around in their garage are better equipped to interact with this kind of person than those who have spent their career in a laboratory looking through a microscope.' 'They have been interested but I don't always know how to validate my idea. Many times there's a language barrier, they speak a different language than us. I haven't had a formal education of any kind so I have a different way of expression.'
Practices for knowledge transfer	Coordination mechanisms	'It's amazing how well our coffee room discussions advance the development projects. There are several ongoing discussions all the time, and that's how the knowledge is transmitted. Of course some of the knowledge is irrelevant but some of it is extremely valuable.' 'We have an ongoing informal meeting procedure, like a brainstorming session for current topics. When people have ideas, thoughts, problems, or technical stuff there's the whole group advising and supporting them.'

4. Case description

Steel Inc. is a European steel company that operates globally. Similar to other process industries its business is characterized by high R&D intensity, complexity, uncertainty, asset-intensiveness, and costly scaling-up from idea to full-scale production (Kurkkio, Frishammar, and Lichtenthaler 2011). The two projects (Table 5) are both radical in that they encompass new steel production processes which enable the production of new products with paradigm-shifting properties. The idea sources can be considered unusual since ideas typically originate from the R&D unit or a stable set of partners such as universities and research centres.

Table 5: Project information

	Project 1	**Project 2**
Inventor	Engineer (internal idea)	Entrepreneur (external idea)
Innovation type	Process innovation that enables new products	Process innovation that enables new products
Innovation novelty	Radical (new-to-the-world)	Radical (new-to-the-world)
Outcome	Successful adoption of a new process led to the introduction of multiple new products.	Failure: rejected by the R&D unit

The first idea was discovered by an engineer within Steel Inc. He faced initial difficulties in convincing managers to begin idea development. Eventually, a team emerged to promote the idea in secret. After the first manufacturing tests, they started to get wider support. Subsequently, it was granted a formal project status and resources. Finally, the project led to the creation of multiple new products and new markets.

The second idea was proposed by an entrepreneur who operates a small company producing steel-based products. The CEO of Steel Inc. got interested in the idea and commissioned the R&D unit to investigate its potential. The idea was not able to evoke interest within the unit. For some time, it remained at a pre-evaluation stage with low priority but in the end, the investigations were shut down before manufacturing tests. For detailed project descriptions see the Supplementary Online Material.

5. Findings

Despite of continuous collaboration with external partners, Steel Inc. faced difficulties in integrating the ideas (Table 6). While only one of the ideas had problems with acquisition, assimilation and transformation were difficult for both. High uncertainties and incompatibility with the prevailing capabilities and business scope hindered assimilation. Assimilation attempts were nevertheless necessary for understanding the ideas and initiating company-wide transformation efforts. Project 1 was able to advance through these phases, whereas project 2 was restrained by the lack of serious assimilation attempts. Differences in the outcomes of the projects were explained by how they were able to utilise SIMs (Table 7).

Table 6: AC capability levels

AC capability	**Project 1**	**Project 2**
Acquisition	**Low** The idea originated within the company and was acknowledged after the persistent initiatives of the inventor.	**High** An entrepreneur contacted the case company CEO with a new steel manufacturing method. There were no previous relations between the parties.
Assimilation	**Low** Unusual source of the idea and the inventor's lack of technical expertise delayed its analysis. Uncertainties regarding the idea's potential and feasibility delayed manufacturing tests.	**Low** NDA limited informal discussions about the idea and impeded idea development. Because of low priority, only theoretical analysis was performed. Metallurgical analysis and manufacturing tests were not conducted.
Transformation	**Medium** Initially the idea was not able to challenge existing cognitive structures. Later, the organization was convinced by manufacturing test results and project team credibility. This generated a search for new application areas which transformed how the company saw its business scope and strengths.	**Low** Existing perceptions of the company's scope and capabilities remained dominant. The idea was considered incompatible with them and was rejected.
Exploitation	**High** The innovation was used to produce better quality products with lower costs in an existing product group. In addition, a new product group was established and a new market created around it.	**Low** The case company did not try to exploit the idea. The inventor continued to work with the technology under his own small business.

5.1 Socialisation mechanisms

The R&D unit in Steel Inc. is a highly socialised community. Its members share similar background, education, and language, and understanding of idea requirements. These mechanisms increase trust and knowledge transfer efficiency but limit knowledge exchange outside the unit. The inventors faced difficulties in communicating with R&D employees because of their lack of status and proficiency in theoretical discussions on metallurgy. According to an R&D manager: *'If you're not in a technical position it will be difficult to convince others. But if a technical employee, who makes decisions on projects all the time, presents an idea, nobody goes against* *him.'* Furthermore, both inventors were confronted with organizational norms and values that shunned risky projects: having supported unsuccessful projects was seen as a professional failure. In project 1, the resistance was overcome with dense connections between the inventor and the R&D team, whereas in project 2 the inventor had no opportunities to influence the idea's development.

5.2 Coordination mechanisms

An open-door policy was a prevalent practice which promoted openness and lowered the threshold to start conversations with colleagues. Prolonged coffee break discussions were also useful in directing the expertise of a wide range of employees towards pressing matters. These practices increased understanding of the idea and promoted assimilation and transformation in project 1. Furthermore, after successful manufacturing tests in project 1, the good news spread very quickly throughout the relevant organizational functions due to interfaces which promoted cross-functional knowledge exchange, and helped grow the coalition to promote the idea: *'We gathered together a reasonably large group of managers from sales, manufacturing, and R&D, and presented our results to them. That was the moment when the sales people got interested and started to explore the market potential.'* (R&D Manager)

There was a significant difference in the two inventors' interactions with Steel Inc.'s R&D unit. In project 1, the inventor had a long and diverse history in the company and wide networks. Unlike the entrepreneur in project 2, he was able to promote the idea's acquisition and assimilation by proposing it to many R&D employees. A vital part of the team in project 1 was a product manager who acted as a boundary spanner across functional borders. He had deep understanding of informal organizational power structures and could advance transformation by formulating the message in appropriate terms, facilitating interactions, and convincing top management.

Table 7: SIMs in the studied projects

SIM	Project 1	Project 2	Related AC capability
Socialisation mechanisms			
Connectedness	Wide networks within the organization helped the inventor recruit supporters.	Lack of connections between the inventor and the company prevented interactions.	Acquisition, assimilation
Shared language, background, and education	Lack of shared technical language between the inventor and R&D managers decreased trust and credibility and limited knowledge exchange. Shared backgrounds and language increased trust and facilitated knowledge exchange among R&D employees.	Lack of shared technical language between the inventor and R&D managers decreased trust and credibility and limited knowledge exchange.	Assimilation, transformation
Values and norms	Values and norms were dominated by conservativeness and risk aversion which were obstacles for uncertain ideas.		Assimilation, transformation
Coordination mechanisms			
Practices for knowledge transfer	Open-door policy and coffee room discussions promoted informal knowledge exchange across functions.	Knowledge transfer practices could not be used due to privacy concerns.	Assimilation, transformation
Cross-functional interfaces	Strong links between organizational functions facilitated market launch.	Idea development was conducted within the R&D unit.	Transformation, exploitation
Job rotation	Helped the inventor form valuable links throughout the organization.	No mentioned benefits from job rotation.	Acquisition, assimilation
Boundary spanners	Project team member with good social skills and networks helped create credibility for the idea.	No boundary spanners.	Assimilation, transformation, exploitation
Systems mechanisms			
Formalisation	Idea selection criteria disallowed highly uncertain ideas.	NDA limited knowledge exchange.	Assimilation, transformation

5.3 Systems mechanisms

Strong formalisation increased the projects' reliance on other SIMs. Strict requirements for project proposals fit poorly with high uncertainties associated with radical ideas. According to a vice president: *'The dilemma is that if you have a technological idea without a sophisticated commercial vision, it is very difficult to mould it into a form that would pass the decision gates.'* The idea in project 1 did not fulfil the selection criteria until quite late and lacked official status and development resources. Project 2 was in a pre-evaluation stage without clear goals and relied on the initiative of R&D employees. Project 1 was, however, promoted by coordination mechanisms that were unavailable to project 2. Furthermore, an NDA which was signed to protect the idea in project 2 limited available resources to seven employees.

6. Discussion

Despite of the studies suggesting that radical innovation benefits from interactions with diverse partners, little is known of what is needed to absorb radical ideas from unusual sources. This study contributes by increasing understanding about the context-specificity of AC and provides suggestions for managers aiming to enhance their organization's radical innovation capability by opening up to new idea sources.

Faced with high uncertainty, the case company's assimilation and transformation capabilities performed poorly. According to current understanding, AC level may vary with knowledge bases and partner characteristics (Lane and Lubatkin 1998). This study identifies two new contextual factors, idea radicalness and accustomisation with the idea source, which affect the utilisation of SIMs.

Each of the AC capabilities (acquisition, assimilation, transformation, and exploitation) was associated with a specific challenge: (1) connecting inventors with the R&D unit, (2) finding resources and motivation to investigate the idea, (3) challenging perceptions of the company's goals and capabilities, and (4) leveraging organization-wide support and competences to introduce novel products. Overcoming these challenges is difficult since the context combines multiple dimensions of uncertainty.

First, unusual idea sources increase the level of uncertainty associated with ideas. Unusual inventors cannot benefit from socialisation mechanisms which generates a barrier to knowledge exchange and trust creation, and consequently to idea adoption. Nevertheless, among unusual inventors, those with more contacts to and similarities with the R&D professionals may be able to utilise more SIMs. Idea radicalness is another source of uncertainty which is poorly suitable with certain socialisation (shared values and norms) and systems (formalisation) mechanisms because radical ideas often challenge companies' existing capabilities and knowledge bases (Todorova and Durisin 2007) and their potential and risks are difficult to evaluate in their early stages. Therefore, under uncertainty, socialisation and systems mechanisms may produce the not-invented-here syndrome where organizational units reject innovative ideas from outsiders (Katz and Allen 1982). Instead, idea absorption relies on coordination mechanisms. Currently, the antecedents of the not-invented-here syndrome are poorly understood (Burcharth, Knudsen, and Søndergaard 2014). The current study links the syndrome with underlying knowledge-related processes. Mechanisms which increase the breadth of knowledge exchange (coordination) are emphasised over those which promote its efficiency (socialisation, systems). So, diversity of idea sources and high uncertainty should be matched with diversity of utilised knowledge bases.

The study presents a micro-level analysis of SIMs and AC capabilities (Martinkenaite and Breunig 2016). It demonstrates how SIMs can be applied to the investigation of the integration of radical ideas from unusual sources, and answers to calls for more qualitative AC process studies at the level of individuals (Easterby-Smith et al. 2008; Volberda, Foss, and Lyles 2010). Especially the early stages of radical idea development are highly reliant on the initiative of individuals (Reid and de Brentani, 2004). The study shows how individual-level interactions may influence project-level success and ultimately explain firm-level capabilities.

The findings suggest that an organizational culture which promotes openness, learning, and trying out new ideas (Herrmann, Gassmann and Eisert 2007) facilitates the creation of AC for radical ideas. Furthermore, the value of boundary spanners in bringing ideas into the R&D unit is emphasised. Companies may proactively search for new ideas by establishing specific idea scout positions (Whelan et al. 2011) and organising idea contests (Elerud-Tryde and Hooge 2014), or reactively maintain receptiveness by establishing idea channels (Ahmed 1998) or adopting IT-based idea management tools (Montoya-Weiss and O'Driscoll 2000). This study suggests that employees which manage these interfaces should be recruited from R&D so that they are socialised with those who will continue idea development. This generates initial trust and decreases suspicions towards the ideas. Moreover, radical ideas from unusual sources might require incubation before integration into the R&D unit. Passing formal selection gates and attracting the interest of R&D employees becomes easier if the idea has been pre-developed by a separate unit (O'Connor and DeMartino 2006). This enables the use of a wider range of SIMs.

Finally, it is important to ensure connections across organizational borders. Cross-functional teams, job rotation, and informal interactions should be promoted to fully utilise the knowledge base of the company. Similarly, NDAs limit interactions among employees and should be avoided when dealing with highly uncertain ideas.

7. Conclusions

The ability to absorb radical ideas from new sources is important for companies in dynamic environments. It is, however, difficult for incumbent companies because high uncertainties require new management approaches. The development processes of two radical ideas from unusual sources in an incumbent global steel company are analysed by evaluating four AC capabilities (acquisition, assimilation, transformation, and exploitation) and related SIMs. Especially assimilation and transformation capabilities performed poorly in the studied projects because of limited usefulness of socialisation and systems mechanisms.

This study suggests that AC capabilities may be context-specific. Two contextual factors are identified: radicalness and accustomisation with the idea source. Their effects are explained by underlying SIMs of which performance is contingent on these factors. Especially strong formalisation and socialisation within the R&D unit may work against highly uncertain ideas.

In the steel industry, radical innovations are rare and difficult to develop. While such circumstances provide opportunities to identify challenges in idea development processes, it limits the generalizability of the results. The industry should be acknowledged as a potential variable which may influence the findings. Future research should examine SIMs and AC in industries with shorter development times and costs, and identify best practices from highly open and innovative companies.

Biographical notes

Matti Pihlajamaa is a doctoral candidate in Aalto University, Finland. His research focuses on radical innovation and open innovation.

Acknowledgements

This work was supported by Tekes – the Finnish Funding Agency for Innovation; and the KAUTE foundation.

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Supplementary Material: Project Descriptions

Project 1 – a technical employee as the inventor

The inventor was a senior employee who had worked his whole career in the company. Throughout his career, he had held various positions in several functions, such as a technician in R&D, a supervisor in quality control, and a technical advisor. Because of his long history within the company he had good contacts to a number of people in different functions, both to blue-collar workers and managers. He was known to be very social and creative and to every now and then sit down with his colleagues to present new ideas. At the time of the studied invention, he was working as a supervisor in the quality control function. The invention was about a new technique in steel manufacturing which he believed could lead to new products with greatly enhanced properties. He presented the idea to several managers who turned him down on the basis that the idea was not metallurgically feasible. While he was very sure of his idea, he was not able to argue for it convincingly as he did not have higher education and related theoretical understanding. Finally after several dismissals, he managed to convince the head of the R&D unit to take a closer look. Afterwards, the inventor's troubles in getting people involved were explained by his lack of credibility. Because he was not involved in production or R&D he was not considered to have the capacity to discuss technical issues.

The head of the R&D unit made calculations based on the idea and concluded that there were no theoretical reasons why it would not work. Despite of this, he considered the idea risky as testing it in practice might lead to accidents which could harm the manufacturing equipment. The inventor, however, did not give up. Instead, encouraged by that the theoretical calculations were promising he continued trying to persuade others of the idea's potential. This still proved difficult as he had a reputation of coming up with 'crazy ideas' and was not taken seriously by many. After some time, he managed to convince an R&D manager responsible of product design to take a look at it. The manager got interested and started to contact others. Because of his good reputation and a high success rate with past projects, he was easily able to get two others behind the idea: another R&D manager with long experience of working with a certain production line, and a product manager from the sales organization.

At this point, the development of the idea did not have an official project status. Instead, it slowly started to proceed unofficially. The two R&D managers conducted laboratory tests which strengthened their belief of the idea's potential. The next step in validating the new technique would have been to conduct large-scale tests at the production line. Here, the team faced lots of resistance. They invited their colleagues to discuss manufacturing tests but the idea was rejected. The team members described the reaction as ‘typical resistance to anything new’ but at the same time admitted that there were still lots of unknowns in whether the production facilities were suitable for manufacturing the new product.

After the unofficial project team was formed, the original inventor was not actively involved anymore. The three remaining members championed the development of the idea, each of them having their own particular strengths. The first R&D manager was responsible of designing how products are manufactured and had the power to decide on what was done at the production line. The other R&D manager was very experienced with the production line that was used to manufacture the test batches. He was able to evaluate that the risks were not too high and that the tests were feasible to run. Finally, the product manager had very good social skills and was able to persuade many key decision makers behind the idea. Moreover, all of them had technical credibility within the organization.

The team decided to conduct the manufacturing tests secretly on the side of another project. The R&D managers, taking care of the technical analysis, planned how the manufacturing tests could be carried out in practice and how to minimize risks. One night, they ran the tests and the outcome was successful. People from several departments came to look at the product and saw that it had very high potential. After this success, the product manager started campaigning for the idea to be acknowledged by the top management. He created a business plan, which he thought was exaggerated at the time, and was able to explain the idea in a way that convinced the top managers. He also made test deliveries of the new product to customers and got positive feedback, which further strengthened the case.

After getting top management behind the idea, the idea got an official project status and resources were allocated for its development. More tests were made and, despite a few setbacks, appropriate manufacturing methods were discovered. The new technique required new investments in the production line which were made after its potential and feasibility were confirmed.

At first the new product was sold to existing customers as an improved version of an existing product. The new method improved product quality while lowering the production costs. Because of its improved properties, existing customers found new uses for the product which further increased its sales. Additional development of the manufacturing method led to the discovery of a new-to-the-world product group. So, besides the improvements to existing products, the invention created a new technological trajectory. Because initially there were no markets for such products, the company put a lot of effort into contacting potential customers and creating demand for it. To exploit the new technological opportunities, the company moved to new markets both in terms of industry and geography. In the end, the sales exceeded the initial business plan estimates hundredfold.

Project 2 – an external entrepreneur as the inventor

The second idea originated from an entrepreneur who had established his own small business around a new method of manufacturing steel. He had manufactured sample products for several applications based on the new method and had gotten very promising feedback from potential customers. He saw that the potential of the method was very high but he was not able to exploit it by himself in a large scale. Therefore, he offered the idea to the Steel Inc. wishing that it would lead to great advances in the steel industry and compensations for him. He contacted the CEO of the company who passed the message to the R&D unit. Two R&D managers then proceeded to meet the inventor.

The initial reception of the idea was positive. Its potential was evident and applications could be found from many areas. An R&D director told that while it was apparent that the inventor did not have much education it was obvious that he knew what he was talking about. There were, however, doubts about two things. First, whether the technology works as the inventor had told, and second, how it would fit into the company's product portfolio. The idea was sent to the R&D unit for investigation. It did not have an official project status. Instead, it was at a pre-evaluation stage of the innovation process. The investigation, however, proceeded very slowly. Typically, new product ideas originate from the R&D unit. If external parties are involved they are universities and research centres with strong ties to the R&D unit. This idea was exceptional in that the impetus to study it was given top-down by the CEO himself. The downside was that nobody within the R&D unit was personally committed and motivated to research the idea. Everyone seemed to have more pressing matters to work on and the externally originated idea was a low priority.

While the technique proposed by the inventor had not been commercially utilized anywhere in the world, a couple of academic studies were found related to it. The studies confirmed that the idea had great potential but at the same time the investigators became suspicious that perhaps every property the inventor had suggested could not be attained. At this point, there were still lots of uncertainties about how the manufacturing of the product would work in practice and what the outcome would be like. The next steps would have been to analyse the samples provided by the inventor and to order small test batches from partners with suitable production lines for its manufacturing. Metallurgical sample analysis was, however, considered not to be likely to provide any new knowledge that could not be derived from the literature. Manufacturing tests would likely have led to increases in understanding of the product, but conducting them is expensive. In the end, there was nobody who was willing to promote the idea to be sent for manufacturing tests. Decision on the idea's future was stalled for a couple of months, until the entrepreneur was given a report which stated that this type of material could not be manufactured in the company's current production facilities and there would be no further collaboration. A business plan was never made, but those working with the idea were doubtful about whether new products based on it would fit in to the company's scope. While they agreed that there would likely be new business opportunities, the problem was that fully exploiting them would have required moving into new market segments.

During its investigation, the idea was protected by a non-disclosure agreement which restricted discussion on the idea to a small group. This was considered harmful as the interviewees emphasized that the early development of new ideas usually benefits a lot from informal discussions, for example during coffee breaks. In this project, practices for leveraging the expertise of a wide range of colleagues could not be used which limited the opportunities to analyse and evaluate the idea. An R&D director argued that because the production processes are so complex, dozens of employees in different positions should be involved when designing new products. The inventor was in no way involved in the investigations made in the case organization. The R&D managers did not consider him valuable in analysing the material or its manufacturing. This can be partly explained by differences in the use of technical language. An R&D director mentioned that someone who has spent his whole life welding stuff in a garage would be better equipped to discuss with the inventor than anyone from his unit.