Achieving ambidexterity

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Abstract
Ambidexterity is the organizational capability to exploit current knowledge and at the same time explore new knowledge. This paper operationalizes this capability by identifying the activities and mechanisms that enable ambidexterity at the operational level. The analysis is performed along the three dimensions of achieving collaboration across domains, harnessing knowledge and coordinating tasks. These dimensions are suggested on the basis of both literature and an empirical case study of a clinic combining research and high-volume healthcare provision.
Achieving ambidexterity
- a study of clinical healthcare

Abstract
Ambidexterity is the organizational capability to exploit current knowledge and at the same time explore new knowledge. This paper operationalizes this capability by identifying the activities and mechanisms that enable ambidexterity at the operational level. The analysis is performed along the three dimensions of achieving collaboration across domains, harnessing knowledge and coordinating tasks. These dimensions are suggested on the basis of both literature and an empirical case study of a clinic combining research and high-volume healthcare provision.

1 Introduction
The question of how organizations at the same time can achieve short-term efficiency and long-term innovativeness has attracted much attention among strategy and organization scholars. Duncan (1976) introduced the term ambidexterity to denote the ability of an organization to perform exploitation and exploration at the same time. Exploitation involves search for improvement of the existing technology and competencies, while exploration involves experimentation with new alternatives. An ambidextrous organization can make better use of its current resources (exploitation) and in parallel explore new resources (exploration) (Gupta et al., 2006). Both exploitation and exploration are learning processes that involve search.

Ambidexterity has been shown to bring several positive effects, such as enhanced knowledge sharing (Im and Rai, 2008) and organizational responsiveness (Gilbert, 2006), leading to increased profitability and growth (Gibson and Birkinshaw, 2004; Lubatkin et al., 2006; He and Wong, 2004).

However, as argued by (March, 1991), exploration and exploitation compete for the same resources, and therefore crowd out each other. Exploitation tends to drive out exploration, due to a tendency of organizations to focus on the short term (Levinthal and March, 1993). The organization must therefore find ways of actively managing this trade-off, described by Thompson (2008) as the central paradox of administration.

Tushman and O'Reilly (1996) suggested that senior management team must spatially separate the two types of activity into differentiated units, but actively align these under a common vision. Other scholars have found that exploration and exploitation can be performed in the same business unit, using parallel structures that enable switching between tasks (Adler et al., 1999), or a context which empowers individuals to actively choose between explorative and exploitative activities (Gibson and Birkinshaw, 2004). Tushman and O'Reilly (2008) conclude that the crucial factor is the leadership required for putting in place the appropriate routines and mechanisms that enable ambidexterity.
Recent studies have called for a more integrated perspective. Kauppila (2010) found that in reality, leadership, contextual factors and structure all interact in enabling ambidexterity. Turner et al. (2013) point out that none of the dominant theories can be fit to the reality of most organizations. The literature identifies in theoretical terms the crucial factors that characterize ambidexterity, but does not address how it can be achieved in practice. It does not explicate the activities and mechanisms that together create the capability to be ambidextrous and lacks a comprehensive insight into how the tensions associated with combining exploitation and exploration are handled in the organization. In line with Felin et al. (2012), I argue that this requires moving the analysis from the organizational level to the operational level of individuals and groups. The question is: How is ambidexterity achieved? This paper addresses this question by identifying the routines and mechanisms used to combine explorative and exploitative activity, and analyzing how they interact to mitigate the associated tensions.

Contexts characterized by high demands for innovation and high output requirements are especially dependent on mitigating the tensions associated with combining exploitation and exploration. Healthcare, being a sector that is constantly struggling to increase productivity as well as innovation, is a case in point. I perform an in-depth case study of a high-volume breast-screening clinic that is brought to accommodate and engage in the exploration of a completely new screening method. By studying the development of the capability to combine exploration and exploitation in this small-scale setting, it is possible to observe the associated tensions and the way they are mitigated (Pettigrew, 1990).

The paper makes two main contributions. Combining the ambidexterity literature with that on search and problem formulation, I propose three salient factors which are crucial in handling the tensions associated with ambidexterity. This framework serves as a tool for studying ambidexterity at an operational level. The framework is then applied in a case study of clinical healthcare, to explore how the factors relate to each other, and to identify the mechanisms and activities that support the capacity to combine exploitation and exploration at the operational level. The paper is of managerial relevance as finding ways to combine explorative research with high-volume healthcare provision is at the top of the agenda of many healthcare practitioners in Sweden.

The rest of the paper is structured as follows. Section two presents the theoretical background and the framework of analysis. Section three explains the research method, and section four presents the empirical case study. The discussion follows in section five while section six contains conclusions and limitations.

2 Theoretical background

Scholars have increasingly devoted attention to how organizations can adapt to changing environment through a combination of efficiency and innovation. This requires augmenting the efficiency of the current way of working (i.e. exploitation) and in parallel developing new ways of working (i.e. exploration) (O’reilly Iii and Tushman, 2008). Exploration and exploitation are here seen as search processes because they by their nature are aimed at learning by solving problems (Gupta et al., 2006). The former involves search exploiting current knowledge and attempts to optimize the current routines. The latter relies on search exploring completely new knowledge and attempts to develop new routines in “a conscious effort to move away from current organizational routines and knowledge bases” (Katila and Ahuya, 2002, p. 1184).
Duncan (1976) introduced the term ambidexterity to denote the capability of an organization to perform both exploration and exploitation in at the same time. This requires managing the tensions that arise due to the differences between the two activities.

2.1 The differences between exploration and exploitation

As proposed by Raisch et al. (2009), ambidexterity implies managing the tensions that arise when combining exploration and exploitation. These tensions can be understood to stem from the differences between the two types of activities.

Burns and Stalker (1961) pointed out that exploration and exploitation require different organizational contexts. Exploitation implies a mechanistic organization, characterized by rigidity, hierarchy and a focus on efficiency. Complexity is minimized and formalization is high. Search is here focused on the improvement of short-term performance. Exploration on the other hand, requires an organic organization that supports loose roles, opportunities to try new things and flexibility in management. Complexity is high, and formalization kept to a minimum. Search is here focused on exploring new areas, where little is known about the possible outcomes (Van De Ven et al., 1999). Performing both exploration and exploitation therefore requires maintaining in one organization two different organizational environments.

The two activities imply very different types of learning which both are self-reinforcing and tend to trap the organization in conducting more of one or the other (Levinthal and March, 1993). Since exploitation stays within the current operative knowledge base, it often leads to success, making individuals want to perform more of it rather than exploring new areas of knowledge. Conversely, exploration is conducted in knowledge areas that are completely new to the organization and it often leads to failure. This makes individuals want to try even newer ideas in an attempt to finally succeed.

Different competencies and mind-sets are required for exploration and exploitation. To make use of the knowledge gained in both learning processes, the organization needs collaboration between individuals focused on either activity.

Scholars have suggested different means of achieving ambidexterity, which implies mitigating the competitive relationship between exploration and exploitation.

2.2 Enabling ambidexterity: structure, context and leadership

Structural ambidexterity literature suggests that ambidexterity requires managing the differences between exploration and exploitation using spatial separation. Tushman and O'reilly (1996) suggested that separate organizational units should be set up to support explorative and exploitative search, respectively. These units should, however, closely collaborate. The essential task for senior management is to set up integration mechanisms that support collaboration. These integration mechanisms should enable individuals working in the spatially separated units not only to share knowledge but also to coordinate search efforts toward shared goals.

This literature (called dual-structure literature) does not say much about how the integration mechanisms should be constructed in detail. It has also been pointed out (see Farjoun, 2010) that in practice it would be difficult to have a complete separation of the two kinds of activities. A unit dedicated to exploration (e.g. R&D) will still have some parts of its operations oriented towards exploitation. Likewise, an exploitative unit (such as production) will also involve exploratory activity.
In contrast to the above, the parallel-structure literature shows that exploitative and explorative tasks can be performed within the same unit. Most notably, Adler et al. (1999) describe how employees at Toyota switch from production routines to improvement tasks organized in cross-functional teams. Rather than utilizing spatial separation, time schedules determine when individuals should be engaged in one or the other activity. By using parallel structures (e.g. production lines and cross-functional teams) within the same unit, organizational members can switch between exploitative and exploratory tasks. The authors identify “meta routines” which serve to improve the current production routines. Due to this parallel set of routines (i.e. the meta routines) the organization can effectively both explore and exploit on a daily basis.

Spatial separation creates the difficulty of integrating the work of individuals working in two separate units. This problem is eliminated in the parallel structures case. However, although the use of meta routines may be suitable for incremental change, it is not clear how to use these to explore completely new methods, which may require completely stepping away from current routines (Katila and Ahuja, 2002).

Introducing what they call contextual ambidexterity, Gibson and Barkinshaw (2004) stress that new ideas will come up if individuals are actively motivated to engage in collaborations outside their own domains. This essentially relies on top management using cultural mechanisms to support both exploitative and explorative activity and motivate individuals to choose suitable combinations of exploration and exploitation. Contextual ambidexterity is defined as “the behavioural [my italics] capacity to simultaneously demonstrate alignment and adaptability across an entire business unit” (p. 209). The authors stress the importance of a supportive business-unit context, rather than the structure of the organization. Following Ghoshal and Bartlett (1994), the authors define context to include the systems, processes and beliefs that shape the behaviours of individuals in the organization. The structural aspects (e.g. meta routines) thus constitute part of the context. The organizational context provides “stretch, discipline, support and trust” (Gibson and Barkinshaw 2004, p. 213). Essentially, such a context empowers the individual to take initiatives outside their own roles, build linkages inside the organization and collaborate with others across domains. This ambidextrous behaviour of individuals results in ambidexterity at the organizational level.

While contextual ambidexterity introduces the agency and the role of the individual, it says little about how the right context should be achieved. As highlighted by Baer et al. (2013), collaboration between individuals from different domains often requires reconciling views and establishing a shared problem understanding. These difficulties can especially be expected in the case of exploitative and explorative search, which imply different mind-sets and competencies. Duncan (1976) highlights that a central factor in facilitating ambidexterity is managing conflicts between actors from different domains, such as R&D and production.

Furthermore, to achieve radical innovation (i.e. new technologies, methods), knowledge need be combined and used in a structured manner (Kogut and Zander, 1992). As Kauppila (2010) highlights, the theory of contextual ambidexterity simply “assumes that exploratory knowledge is produced somewhere and is available for use” (p. 286). A central function of ambidexterity is to find and integrate knowledge from both internal and external sources (Raisch et al., 2009). Duncan (1976) explains that the low degree of formalization and centralization characterizing exploration essentially serves to enable the broad information input necessary to identify new
areas for innovation. Specialists from different parts of the organization must contribute in scanning for new sources of knowledge, and interpersonal relations must be actively facilitated to support exchange of ideas between explorative and exploitative domains.

Both structural and contextual ambidexterity highlights the role of senior management in the orchestration and integration of exploitative and explorative activities. Duncan (1976) originally stressed the role of senior management in enabling ambidexterity by legitimizing it in the organization. This can be done by incorporating it into daily activities, thus making it part of the role expectations of organizational members. O’Reilly and Tushman (2008, p. 200) state that “ambidexterity is a specific capability embodied in senior leadership’s learning”. Gibson and Birkinshaw (2004) similarly attribute to management the responsibility for enabling collaborations combining exploitation and exploration. However, the literature is to a large extent void of what these managerial actions actually are.

2.3 Analyzing ambidexterity at the operational level

For the organization to increase long-term performance, learning from exploration and exploitation need be combined and incorporated in new routines and technologies (Nelson and Winter, 1982). As discussed above, this requires enabling collaboration between specialists from each domain, facilitation of knowledge sharing, as well as coordinating exploitative and explorative tasks. Because ambidexterity is an organizational capability, it requires being able to do this repeatedly, by using routines and mechanisms that foster the appropriate interactions (O’reilly Iii and Tushman, 2008).

The theories mentioned above, describe ambidexterity at a relatively high level of abstraction. They put forward structure, context and leadership, respectively, as crucial – but not excluding – aspects of ambidexterity. While each perspective provides important insights, these theories still remain very general. As Turner et al., (2013) rightfully point out, a tendency towards higher-level analysis and the use of abstract concepts have not provided much insight into the actual activities that can be used to support ambidexterity. When Duncan (1976) originally introduced the concept of dual structures for ambidexterity, he stressed that managing conflict and interpersonal relations between individuals from different domains is key. This way explorative and exploitative tasks can be coordinated and knowledge flows enabled despite domain differences.

To investigate ambidexterity in terms of activities, routines and mechanisms applied to combine exploration and exploitation, the analysis should be performed at the operational level, explaining e.g. what the manager actually does to achieve ambidexterity. At this level, structure, context and leadership, are intertwined to result in the activities combining exploration and exploitation. The organization must develop routines and mechanisms to support repeated interactions between individuals performing exploitation and exploration.

Based in the literature review, combined with empirical observation in the case study below, I propose three factors as central to analyzing the capability of combining explorative and exploitative activities. To describe the operational-level routines and mechanisms that enable ambidexterity one should explain:

1. How collaboration between individuals from explorative and exploitative domains is achieved
2. How relevant knowledge is captured across the organization
3. How the appropriate distribution between explorative and exploitative tasks is achieved.

Conducting operational-level analysis along these factors makes it possible to operationalize the capability of ambidexterity in terms of the activities and mechanisms used to achieve it. The three factors are discussed in more detail below.

Factor 1: Achieving collaboration that enables exploration and exploitation

Gibson and Birkinshaw (2004) point out that ambidexterity requires collaboration across domains. The latter presupposes that individuals take initiatives outside their job roles, show cooperative behavior and create linkages across domains in the organization. Since exploitative and explorative activities imply different mindsets, there need not be any immediate ground for collaboration (Duncan, 1976). For example, it has been shown empirically that collaboration can be hampered because managers from different departments tend to focus on their own domain (Dearborn and Simon, 1958). Scholars have suggested that problem formulation is crucial for collaboration in heterogeneous groups (Cronin and Weingart, 2007). The actors involved must therefore, prior to commencing search, reach a shared understanding of the problem and agree on a common objective.

Baer et al., (2013) identify hinders that need to be overcome to enable joint problem formulation. Because of what has been termed tunnel vision, actors tend to focus on their own knowledge domain when interpreting problems. Due to heterogeneous objectives, individuals that view problems from the perspective of their own domain may choose not to accept any other formulation (ibid.). Difficulties can also arise due to heterogeneous knowledge sets. Studies have shown that actors tend to focus on discussing shared knowledge, leaving out the relevant, individually held, knowledge (Larson et al., 1996).

Factor 2: Harnessing knowledge

Raisch et al. (2009) point out that ambidexterity depends on the ability of the organization to integrate knowledge stemming from external and internal sources. Duncan (1976) similarly stressed that the ambidextrous organization needs to harness the knowledge needed in the sense of locating the knowledge sets and making use of them in the organization. An essential part in combining exploration and exploitation is to locate knowledge in distant sources outside the organization that is applicable to problems and opportunities in local operations.

Looking for external knowledge sources is called distant search, while looking for knowledge within the organization is called local search. Both local and distant search can bring about innovation, although of different types (Gupta et al., 2006).

Local search helps to improve the efficiency of current technology and working practices (Katila and Ahuja, 2002). Since the scope of search largely is confined to the current knowledge base, local search can be understood as the exploitation of current knowledge. In contrast, distant search focuses on the areas where the organization holds little knowledge, in “a conscious effort to move away from current organizational routines and knowledge bases” (Katila and Ahuya, 2002, p. 1184). Distant search can be understood as exploration of new knowledge (March, 1991).

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1 Ambidexterity requires collaboration between exploitation and exploration in the general case, even if ambidexterity without collaboration in principle is conceivable.
Local and distant search are self-reinforcing, leading actors involved in each toward more of the same type of search. These actors typically hold different cognitive structures, objectives and knowledge sets, and belong to different departments. The archetypes of actors involved in local and distant search would be the researcher and the operations manager, one looking for new methods, the other optimizing current practice.

Despite their self-reinforcing character, the two types of search are complementary. Distant search requires both inspiration from and tests within the current working practice. Similarly, local search needs to be complemented with new knowledge, in order to develop new products and services. The routines and mechanisms employed at the operational level should support this combination of exploitative and explorative search. This can be seen as a form of spanning organizational boundaries, e.g. between departments, to scan for knowledge that holds potential for solution. This may require actively nurturing ideas and creating a context for knowledge sharing, as well as finding ways to capture ideas and knowledge gained in different search activities.

**Factor 3: Coordinating tasks**

As first highlighted in the literature on ambidexterity, combining exploration and exploitation relies on enabling both types of tasks in the organization. The two activities have different scopes. While exploration looks for completely new knowledge, exploitation seeks to improve current routines incrementally. The first relies on allowing specialists freedom in defining tasks, while the latter relies on rules and procedures that guide incremental development (Duncan, 1976). To maintain ambidexterity the organization must coordinate both types of tasks. This requires an appropriate distribution of tasks among personnel.

The two types of tasks typically employ two modes of search described by Gavetti and Levinthal (2000). Exploitation employs backward-looking experiential search while exploration employs forward-looking cognitive search. Experiential search involves trying out different alternatives in search for the desired outcome. It can be understood as experimentation. The main advantage of experiential search is that a specific solution is actually tested in practice. The main drawback is that performing trials is laborious, which severely limits the amount of possibilities that can be tested in this way.

Cognitive search involves using theoretical models to evaluate alternatives without performing trials in practice. A clear benefit is the ability to investigate a wide range of possibilities without using much resource. The main drawback is that accuracy is lower than in experiential search, because alternatives are evaluated on the basis of a model of the world, rather than in actual trials. Cognitive search is suitable for complex, ill structured problems where knowledge is dispersed.

The two search modes are complementary in that one guides the other. For example, Fleming and Sorenson (2004) show how science (exploration) may fill the function of a map guiding where to try out new potential solutions in daily routines (exploitation). However, a central difficulty is coordination of the two types of search, and finding how to gain the synergy where one guides the other.

**2.4 The framework for analysis**

The factors discussed above form the basis of the empirical analysis of how exploration and exploitation are combined at the operational level. The analytical framework is shown in Figure 1. In each factor the arrows point towards the two types of activities that are to be combined.
The first factor refers to collaboration, which is a pre-requisite for combining exploration and exploitation. Collaboration can take place only when possible conflict of interests between the actors is overcome and a shared understanding of the problem developed (Baer et al., 2013; Nickerson and Zenger, 2004).

The second factor of the framework refers to obtaining the knowledge needed. An example is gathering ideas from people in an outside the organization. Local search employs the knowledge set in use in daily operations, while distant search looks for other (possibly unknown) knowledge sets.

The last factor refers to the distribution of tasks between experiential and cognitive search (Gavetti and Levinthal, 2000). Experiential search, i.e. performing trials, is typical for the exploitation approach, while cognitive search, i.e. theoretical models, is typical for the exploration approach.

Figure 1: Analyzing ambidexterity

3 Method

3.1 Research design and setting

To empirically explore ambidexterity at the operational level, an exploratory research design is suitable (Felin et al., 2012). As explained by Yin (2009), a case study is suitable when ‘how’ or ‘why’ questions are being posed and when the focus is to study a phenomenon in its context. Because empirical detail was required, an in-depth single case study was chosen.

A representative case is one where the studied phenomenon is transparently observable (Pettigrew, 1990). The case was theoretically sampled. On-going attempts at building breast cancer clinics integrating both research and high-volume healthcare delivery made it possible to study how exploitation and exploration are combined. Furthermore, data collection during the course of developing the ambidextrous clinic made it possible to gain insight into the rationale behind choices made. The clinic is taken as the unit of analysis, because the studied attempt is managed on the level of the clinic.
Because the aim was to elaborate theory rather than test theory or generate completely new theory (Ketokivi and Choi, 2014), an abductive research method was used, performing continuous iteration between general theory and empirical data (Karlsson et al., 2010). A conceptual framework guiding the analysis was developed based on high-level theory from the literature, in combination with observations from the empirical case study. For example, the literature on ambidexterity to date does not devote much space to the study of how knowledge from exploration and exploitation is attained and combined (although this is pointed out as a central factor, see Raisch and Birkinshaw, 2009). However, attaining and using knowledge emerged as a central theme in the case study, and consequently this was made a central part of the framework for analysis.

The research setting is the diagnostic stages of breast cancer care, also referred to as mammography. The studied case is part of a larger initiative aimed at creating integrated breast cancer care in Sweden. New clinics for breast cancer are being designed to integrate research and clinical practice. In the chosen clinic, a specific initiative aimed at finding more efficient methods of screening for breast cancer was being performed. The process of engaging the clinic in this initiative was the first major attempt at systematically combining research and clinical practice in the clinic, and became representative of the new type of clinic being designed. The senior healthcare managers involved regarded it to be a blueprint for integration of research and clinical practice.

The study was carried out over a period of 8 months, and at the start of the study the project had been running for approximately three years. Integration was well under way, but obstacles and choices from previous stages were fresh enough to be explained in interviews. Activities combining research with clinical practice were actively being worked on, and obstacles handled, which made it possible to gather data as challenges and possible solutions were being discussed and developed.

### 3.2 Data collection

To understand how combination of exploration and exploitation was achieved at the operational level, 17 semi-structured interviews were conducted with researchers and clinicians. Interviewees included researchers and clinicians involved in or affected by the initiative, at all levels of the organization.

Each interview lasted approximately 60-80 minutes, structured around the following themes:

- The daily work of the interviewee
- Their view upon research and clinical practice respectively
- Their involvement in on-going initiatives
- The purpose, means and outcomes of collaboration between the clinicians and researchers
- The activities performed in the specific research initiative for breast cancer screening
- The reason for choice of activity
- Obstacles in combining research and clinical practice in the specific initiatives
- Solutions and ways of by-passing obstacles
- Modes of interaction between the researchers and clinicians, and the purpose of the interaction
- Motivation to conduct research and/or clinical practice
• The interviewee’s view of the knowledge and competencies of clinicians and researchers respectively.

To complement the interviews, observations of meetings were used to gain insight into interactions taking place, and the reasoning behind choices made. This also served as a means of triangulation, by juxtaposing what was stated in interviews with observations. Because measures for combining research with clinical practice were actively discussed and decided upon at these meetings, an understanding of the underlying rationales could be gained.

Documentation was also used as a data source, comprised of a report on how the X-ray machine of a clinical routine was adjusted to accommodate a research initiative, and extensive documentation of the initiative to integrate clinical practice with research activity. Analyzing multiple sources helps to converge evidence and establish more reliable understanding of the studied phenomenon (Yin, 2009).

Table 1 summarizes the main sources of evidence.

<table>
<thead>
<tr>
<th>Source of evidence</th>
<th>Description of source</th>
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</thead>
<tbody>
<tr>
<td>Interviews</td>
<td>17 semi-structured interviews with clinicians and researchers. Respondents came from different levels and specialties in the organization, including clinical and research nurses, physicians, and full time researchers.</td>
</tr>
<tr>
<td>Observations</td>
<td>8 hours of observations from meetings. 2 x 2 hour meetings between researchers and clinical personnel, and 2 x 2 hours of meetings among researchers.</td>
</tr>
<tr>
<td>Documentation of the new clinic</td>
<td>Documentation describing the vision for a clinic combining high-volume healthcare provision with research activity.</td>
</tr>
<tr>
<td>Specific change documentation</td>
<td>Documentation of how standard operating procedures for x-ray operation were changed to accommodate research initiatives.</td>
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### 3.3 Data analysis

Data analysis was started while the fieldwork was still proceeding, in order to make sense of the data and adjust data collection to benefit from gained insights. Notes were made during and after each interview and observation. Interviews were transcribed and analyzed. Detailed case write-ups were used to obtain insights, conduct within-case analysis and guide triangulation (Pettigrew, 1990). The data analysis was guided by existing literature, but the empirical material was also used to identify which factors of ambidexterity that were central at the operational level, thus contributing to making sense of how to understand previous literature in this particular context.

To uncover the routines and mechanisms used to combine research and clinical practice, these were identified in the empirical material, and categorized according to the factors of the framework. Identified routines and mechanisms were then further investigated. For example, as routines for communication emerged as a central element, their form and implications were further investigated in subsequent
interviews. In this way, routines and mechanisms were uncovered, and their function analyzed. Sketches and illustrations were used as a method of identifying how different factors related to each other (Miles et al., 2013).

A summary of the empirical findings is given in Table 2.

4 Case study: Combining research and clinical practice in search for a new method for screening in breast-cancer care

4.1 Background – the breast cancer screening project
A mammography clinic, located in a large hospital, is in charge of screening for breast cancer. The screening process involves examining apparently healthy women to detect breast cancer. All women in Sweden between the ages of 40 and 74 undergo routine screening. Approximately 1500 women per week pass through the screening process. The initial mammography takes approximately 7 minutes. The woman is registered and X-rays are taken. If a tumor is found or suspected, she is called back for further examination using ultrasound and sometimes MRI (Magnetic Resonance Imaging). If the tumor is confirmed, she is called back for treatment.

It is mostly nurses who perform mammography. Two radiologists (separately) review each X-ray image, and they handle about 500 X-ray images per day.

The standard method of mammography has been in use for about 30 years. It is considered to provide the best tradeoff between diagnostic accuracy and volume of patients. The disadvantage of the method is its inaccuracy for women with high tissue density. Little attention has up to now been given to more accurate technologies, which can cope with high tissue density, since they do not meet the high volume requirement. Moreover, the clinic has limited possibilities of trying out new technologies, due to high patient volumes.

The vision of the studied initiative was making breast cancer screening more accurate and the clinic more efficient by concentrating resources on those women who have a higher risk of getting cancer. The aim of the project was to find a method to assess each individual’s risk of getting breast cancer. The hypothesis was that this risk increased with tissue density. By developing a method for making this risk assessment at an early stage, the clinic would gain the opportunity to concentrate resources on women with higher risk of cancer.

The research project was explicitly aimed at changing the clinical practice in screening for breast cancer, which required collaboration between researchers and clinicians. The objective was to corroborate empirically the density hypothesis and to find a method of measuring tissue density that could be implemented in the screening process without slowing it down.

4.2 Enabling collaboration to find a new screening method
At the outset, there was a clear difference of interests between the researchers and the clinicians. The researchers needed the knowledge of clinicians in order to be able to develop a method that could benefit clinical practice. However, the clinicians could only accept research initiatives that a) required limited resources, b) provided a well-defined way of evaluating the outcome, c) were relevant to clinical practice. An initial suggestion of a more general study was turned down as benefiting mainly the research community. A radiologist stated:
“We notice that the questions that are really important to them [i.e. the researchers – my addition] aren’t the ones we are passionate about (...). We are interested in: ‘does this method work or not? Is this a better method or not?’ They have a wider perspective: ‘what can we do for this big group of women and the breast cancer diagnosis?’ (...) Our questions come up during our work, [and are] not based on a wide perspective on healthcare”.

Thus, although both parts were in their own ways interested in collaboration, at the outset it was by no means clear which form this collaboration should take. Both parties wanted to conduct research. However, the conditions put forward by the clinicians were restrictive in terms of resources that could be dedicated to joint research. Unless the research initiative served to investigate a well-specified problem, collaboration could not be pursued. The investigation of tissue density as a risk predictor was at an early stage, and did not match these criteria.

To move past this stalemate, three approaches were taken: a) inclusive communication of shared vision by senior management, b) routines for capturing data from clinical practice and c) implementation of new measurement technology in clinical practice. These approaches are described below.

Inclusive communication of shared vision by senior management. Regular meetings with the whole clinic, including nurses, physicians, researchers, and other personnel, were organized. The head of research led the meetings. Progress in ongoing projects of the research team was reported, and questions and discussions on these topics were encouraged. The vision of collaborative research was communicated, along with the possibilities this entailed both for clinical practice and breast cancer medicine. Several interviewees reported that these meetings were key to creating a team spirit, and that the presentations by the head of research inspired them to believe that they could accomplish much together. The fact that everybody was invited, regardless of whether they were directly involved in the ongoing initiatives, was also pointed out by both clinicians and researchers to be a key component in building a collaborative atmosphere and creating a mindset embracing joint search for new treatments. It increased the willingness to put work into finding ways of combining high-paced clinical practice with systematic search for new treatments.

Routines for capturing research data from clinical practice. IT connections were set up to enable data extraction from the clinic’s data system. Moreover, in order to test the tissue density hypothesis, researchers needed access to the clinic’s patients. The offices of the research project were set up on hospital premises, in the same corridor as the mammography clinic. The research unit was designed to become a “continuation” of the routine process that patients passed through at the mammography clinic. Clinicians informed patients about the possibility of taking part in the study. A sign in the corridor showed women leaving the mammography clinic the way to the research unit, which was a few meters down the corridor. Inside the research unit, women passed through a routine process involving a questionnaire and medical tests. It took about 5 minutes and up to 100 women per day were examined. As stated by the manager of the research project:

“We reached the conclusion that being [geographically] close [was crucial], and that it [i.e. data collection] should be quick and simple.”
A nurse at the research unit stated:

“We have set a tight schedule [at the research unit] which has to be observed, otherwise it would delay the patient [in the flow through the mammography clinic].”

Implementation of new measurement technology in clinical practice. The routines for capturing research data gave initial results supporting the tissue density hypothesis. Subsequently, the researchers added a software module to the X-ray machines of the clinic. It measured tissue density and saved the data to the research database without in any way affecting the clinical process.

The researchers described in interviews that the implementation of the new software spurred increased interest from the clinicians, who became interested in how measurements of tissue density and risk-based screening could be used in clinical practice. The ground for a joint project was laid. The manager of the research project stated:

“The discussion with clinicians improved. (...) We have shown [in the research unit] that the method has potential. (...) With the [newly inserted] technology the clinicians can perform the tests themselves. (...) But then the question arises ‘how should we [i.e. the clinicians] use this in [clinical] practice?’ and then the next step is natural, ‘let’s make a study [to find out]’ (...) and we suggested to undertake studies together.’”

This way the perspective and ideas of the clinicians were incorporated in the joint discussions between researchers and clinicians.

4.3 Harnessing knowledge: Looking for new methods for clinical practice

The initial research hypothesis had to be further developed to be implemented in clinical practice. Ideas were needed on what method and technology would potentially fit a high-volume screening process. To gather ideas from both researchers and clinicians the following approaches were used.

Regular information to clinicians. Researchers presented regular progress reports to all clinic staff. Clinicians stressed in interviews the importance of these reports. One nurse explained:

“I think [reporting] results [to the clinic] is very important. (...) It is very important to know what the studies are about, and how things are going, and who is involved. (...) It is important because [now] we are part of the same team.”

Information was also given to the staff of other clinics. At an annual event at the hospital, the head of research together with a clinician presented their collaboration and on-going research initiatives. The aim of developing a better screening method for breast cancer was highlighted, as well as progress towards the aim.

Extensive information and progress reports were also provided on the project’s website.

Recruitment of clinicians with interest in research. Interest in research was taken into account when employing new personnel. A clinician who stressed interest in research within radiology was employed during the case study.

Support to clinical studies. To enable and encourage clinical research, the researchers offered supervision of the clinical studies suggested by the clinicians, as well as help in applying for research funds. Clinical studies were supported in order to
spur interest in research, even when their subject matter was not completely in line with the screening project. Clinicians stated in interviews that having research competence close by was a big asset and made it possible to develop research ideas. A nurse said:

“They [i.e. the researchers] have extensive academic knowledge, and they have the possibility to help and support clinical research here at the breast clinic, both in mammography and surgery, so there is the possibility to use them as an academic resource and to discuss our ideas.”

Presentations of joint research for new nurses. Furthermore, all new nurses were, apart from their clinical training, given an introductory presentation of the collaboration between researchers and clinicians. The nurses were encouraged to get involved in research as part of their work at the clinic and to contribute with their own ideas.

Routine to capture research ideas. Clinicians were encouraged to come up with research ideas. As collaboration between researchers and clinicians gradually developed, a routine for capturing ideas was set up. Personnel in all parts of the organization were encouraged to communicate their ideas at any time to anyone in the management team. All proposed ideas were quickly discussed and evaluated in a joint meeting of the managements.

One of the suggestions put forward by the clinicians was to try out a short protocol for Magnetic Resonance Imaging (MRI), which had been used abroad. MRI is regarded to have the highest accuracy in detecting cancer tumors, even in breasts with high tissue density, and is more effective at finding cancer than mammography. Ordinary MRI takes 40 minutes, which is why it is only used for high-risk patients. The shorter protocol takes 3 minutes, while mammography takes approximately 7 minutes.

The strength of the short-protocol MRI was that it fit the objectives of both the researchers and the clinicians. The method could be used to check whether certain tumors were missed in mammography and thus to verify the value of tissue density as a predictor of the risk of breast cancer. At the same time, since short-protocol MRI was more efficient than mammography, it was of value to the clinic regardless of whether research on tissue density proved successful or not. A clinical radiologist stated:

“We have started with MRI and think it is a very exciting new method, and we have read about the shorter protocol (...) and that’s when (...) we [i.e. clinicians and researchers] found each other. (...) We want to know ‘does the method work?’”

4.4 Coordinating tasks: Carrying out joint search activities
As ideas were continually gathered and evaluated, the management chose to pursue some of them. Tasks were distributed between the researchers and the clinicians. The clinical management highlighted in interviews that the patient flow could not be compromised and that clinical research must be carried out “in pace” with daily clinical practice.

Two approaches were pursued when carrying out the chosen research initiatives: a) careful operational-level planning and b) research activities spread out across current clinical routines. These two approaches are described below.

Routine for planning at the operational level. The top managers of the clinic stressed in interviews the importance of detailed planning of joint research initiatives.
Detailed planning could enable allocation of resources to research efforts without disrupting the patient flow. The head of the clinic stated in an interview:

“We have to (...) keep the clinical process intact and accommodate research. (...) Planning is essential in order to reduce the amount of problems that come up along the way.”

Once an idea had been deemed viable by the joint management, the chief nurse was usually appointed to lead the operational planning. A detailed plan was created, including the type of patients, when and how the study should be carried out and who was in charge. This was summarized in a document stating the Standard Operating Procedures (SOP) for the study.

Planning at the operational level could require 4-5 meetings, involving both physicians and nurses. As stated by a nurse:

“It may take just one person to get an idea, but then it usually requires 6 or 7 nurses and one or two physicians to perform the study. (...) So we sometimes have 4 to 6 meetings to plan the logistics, to set the routines [i.e. the Standard Operating Procedures] for the study.”

If issues arose in this process, they were referred to the management team. A nurse involved in research initiatives highlighted that, despite careful planning, issues always arise as the study is carried out. It was highlighted as central in such situations, that the researchers should be located in the vicinity of the clinic, so that they could easily be reached for questions.

Researchers and clinicians often had to show flexibility when they collaborated in planning and carrying out search initiatives. For example, researchers wanted dedicated nurses to conduct X-ray scans on research patients, in order to assure uniformity of the X-ray pictures. Clinical management declined to have these nurses on stand-by for certain patients, due to the disruption this would cause to the clinical process. Instead, a schedule was set up, such that patients that were part of the study came at pre-determined hours when the designated nurses were also scheduled to work.

*Spreading out search activity across current clinical routines.* The short-protocol MRI could be tested within the standard MRI routine. The clinicians could evaluate the new MRI technology doing what they did every day, namely taking care of patients. A radiologist stated:

“[For] all the patients that are going to MRI, we are doing the short protocol. So we are collecting material. The good thing is that with this short protocol, maybe in one year we can say ‘let’s see (...) [only] the short protocols’”

The researchers extracted data from the clinic, and sent certain patients for MRI. The chief nurse spread out these patients over time in the MRI-schedule, attempting to find available slots. Thereby the resources of the clinical process were not overly strained, even though extra MRI-patients were handled for research purposes. The chief nurse stated in an interview:

“To make it work, I find slots where the [research] patients can be fit in (...) I spread them out so as not to disturb the daily program.”
In a similar fashion, research activity was included in the mammography routine. When the researchers tried out a new medication, the mammography procedure in the clinical process was altered in order to produce the tests that were needed to assess the effects of the medication. For research patients, an additional test was taken using a new protocol in the X-ray machine. This protocol took slightly different pictures and required somewhat more time to perform. Two nurses were designated and trained for this adjusted mammography routine.
<table>
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<th>Factor</th>
<th>Sub-categories</th>
<th>Activities employed to combine exploration and exploitation in the studied case</th>
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| Achieving collaboration across domains     | • Mitigating tunnel vision, reconciling objectives                              | • Inclusive communication of shared vision by senior management team  
  Regular meetings for the whole clinic, where the vision for collaboration and its advantages for clinical practice were presented  
  • Co-location and data collection for joint discussion  
  IT connections were set up to enable data extraction from the clinic’s data system. The research unit was designed to become a “continuation” of the routine process that women patients passed through in the mammography clinic. This way the research hypothesis was developed without disturbing clinical practice.  
  • Implementation of new measurement technology in clinical practice  
  Based on the data collection, the researchers added a software module to the X-ray machines of the clinic. The implementation of the new software spurred increased interest from the clinicians |
| Harnessing knowledge                       | • Nurturing ideas and drawing out knowledge                                   | • Nurturing ideas: Routines for communication across specialties  
  o Regular progress report in clinical terms where everyone is invited  
  o Introductory presentations of joint research for new nurses  
  o Presentation of joint research to the rest of the hospital  
  o Hiring of clinical personnel with interest in research  
  o Spurring interest by providing support to small individual studies  
  • Routine for capturing ideas:  
    o Senior management set up a routine to continually capture ideas from clinical personnel |
| Coordinating tasks                         | • Managing different search activities in parallel  
  • Using one search mode to guide the other | • Routine for planning on the operational level  
  Once an idea had been deemed viable by the joint management, the chief nurse was commonly appointed to lead operational planning. A detailed plan was created, including exactly what type of patients that should be included, who should carry out the study, as well as when and how it should be carried out.  
  • Spreading out research activity across current clinical routines  
  To enable MR scanning of certain patients for research purposes, the chief nurse "spread out” these patients over time in the MR-schedule. Thereby the standard capacity of the clinical process was not overdrawn even though extra MR-patients were handled for research purposes. Similarly, a new type of measurement was made using a new protocol in the x-ray machine. In planning joint search activity, mutual adjustment between researchers and clinicians was needed. |
5 Discussion

Table 2 summarizes the empirical findings. Each factor of analysis is discussed in the following.

Achieving collaboration. In the case studied, researchers and clinicians initially had differing views on the potential of tissue density measurement, which precluded collaboration. Extensive communication was used to create a common vision. A crucial step was the introduction of a new module in the clinic’s X-ray machine. This spurred discussion and motivated the clinicians to think about the potential use of tissue density measurement. The clinicians came up with their own ideas of how the tissue density measurement could be used in clinical practice, thus formulating a problem that they had the aspiration to solve.

In theoretical terms, the researchers’ knowledge of tissue density as a risk predictor was articulated and codified. Zollo and Winter (2002) highlight articulation and codification of newly acquired knowledge as a central step in incorporating it into operational routines.

The newly explored technology was made available locally, and personnel engaged in exploitative activity were given the opportunity to make their own interpretations of how it could benefit the clinic. This created a context where individuals were motivated to move between exploitative and explorative activity (cf. Gibson and Birkinshaw, 2004). Finally, a shared understanding of the problem and a common objective were established.

A crucial point is that this common objective was achieved through integration of perspectives. Neither the clinicians nor the researchers imposed their perspective on the others. Rather, an extended perspective, comprising the exploitative and the explorative views was established. This exemplifies how the appropriate interpersonal relations, suggested by Duncan (1976) as a key enabler of ambidexterity, can be achieved.

Ideas resulting from exploitative or explorative search are context specific. While an individual may be interested in both exploration and exploitation, the understanding of what exploration and exploitation implies can be expected to differ between individuals depending on their local context. To an individual working in R&D, exploration may imply looking for completely new methods, while an individual working in production perceives exploration as something that can easily be applied in the local environment. Based in this tendency, there may be difficulty in getting newly explored possibilities to be accepted in the local context. Likewise, local ideas may not match with perceived possibilities based on newly gained external knowledge.

Harnessing knowledge. In the case study, the researchers put their expertise at the clinicians’ disposal by offering to assist with supervision in research. The clinicians provided ideas for the use of the MRI and other clinical research projects. Both parties became familiar with each other’s expertise. Senior management set up routines for regular communication regarding what was being done and who were involved in different efforts. Regular progress reports were produced.
In theoretical terms, knowledge integration was taking place. The clinicians and the researchers became familiar with each other’s field without becoming experts in it. Ideas from both fields were employed and integrated into the common knowledge set. Knowledge sets important to the project were located and tapped into. The ideas regarding new technology, e.g. the new MRI module, are examples of distant search, while the ideas stemming from the current clinical knowledge are examples of local search.

Two main prerequisites for knowledge integration can be identified in the case. First, new ideas were encouraged throughout the entire organization and thus new knowledge emerged. Second, the relevant ideas were captured and employed to guide search activities.

It was thus crucial to nurture ideas among people from different domains, and diffuse these ideas through structured communication. Motivating specialized actors to contribute knowledge from their own domain is necessary when the domain is complex and it is hard to judge where possible solutions may reside. As stressed by Duncan (1976), exploration requires a certain degree of complexity based in the unrestricted collaboration between many different specialists.

The present case exemplifies how to combine the required complexity with structured implementation. The role of management was to support the active participation of different specialists, and to capture, evaluate and select which ideas for innovation to pursue. This served to engage the broader organization in idea generation, while limiting the number of initiatives being pursued.

To be able to absorb external knowledge, the organization must already have a certain level of related prior knowledge (Cohen and Levinthal, 1990). The specialization and knowledge depth that come from exploitation must therefore be combined with a knowledge breadth. This breadth was gained by nurturing, spreading and capturing ideas throughout the organization.

Coordinating tasks. The head nurse was responsible for planning how trials should be performed and for creating a document with Standard Operating Procedures for the study. Trials were subsequently spread out over time to fit in with the activities currently going on in the clinic.

Extensive planning was used to fit experiential search into current operations. Furthermore, search activity was made part of the daily production routines, thus integrating exploration and exploitation. For example, the daily MRI and X-ray production routines were used to gather data for exploration.

Planning and rigid sequences of tasks have been regarded in the literature as contradictory to exploration (Burns and Stalker, 1963). The case study provides a different perspective. Planning is here used as a tool to enable exploration within production routines. To carry out experiential search, the operational personnel made planned, incremental adjustments to clinical routines.

The incremental changes introduced into routines were designed to support exploration while minimizing sacrifices in efficiency. This indicates that stable routines may support the organization in innovation activity (cf. Farjoun, 2010), which contrasts with the traditional view of exploration as void of stability and formalization. Moreover, combining exploitation and exploration may hinge on

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2 Knowledge integration is here understood in a wide sense. While one might argue that knowledge integration takes place only when individuals with different knowledge sets together solve a problem, here I assume that informing clinicians about the ongoing research projects also constitutes a form of knowledge integration.
creating an environment stable enough to support integration of external knowledge without disrupting daily production.

6 Conclusions
Ambidexterity has attracted much research but there is still little known of how it is achieved in terms of operational-level activities. As stressed by Turner et al. (2013), none of the dominant theoretical streams on ambidexterity can be applied in isolation to explain how an organization should act to achieve it.

In this study, the main theories of ambidexterity were combined, and complemented with empirical observations, to create three factors appropriate for operational-level analysis: collaboration across domains, harnessing knowledge and coordination of tasks.

The results stress the need to bridge the different mental perceptions associated with exploration and exploitation, respectively. Because both explorative and exploitative search activity is needed to find implementable solutions, the pursuit of a common objective is central. While spatial co-location is used as a way of easing access, this is not enough to unite personnel around shared, ambidextrous objectives (i.e. trying something new while sustaining the old). Because contexts of exploration and exploitation are still different (e.g. a research laboratory compared to a high-volume clinical process), shared objectives rely on making an idea relevant and understandable to personnel from both contexts. This study indicates that codification of knowledge may be a crucial step in achieving this.

Furthermore, intertwined with the achievement of a common objective, is the need to nurture and capture ideas throughout the organization. In organizations with high knowledge specialization among individuals (such as clinical healthcare), it is very difficult for management to get a comprehensive view of the problems and opportunities in different parts of operations. To nurture ideas in different parts of the organization, personnel must not only be invited to contribute, but also regularly updated on current efforts, newly identified possibilities, and who to turn to. Each person must be made aware of what others know and do, to see the potential of contributing with knowledge from his or her own domain. This study indicates that creating knowledge of “who knows what”, i.e. making everyone aware of the competence at hand, may be a crucial part of motivating personnel to step out of their roles and contribute with ideas and resources. Although highlighted in strategy literature (see Argote and Ren, 2012), this need for mobilizing knowledge throughout the organization has largely been overlooked in the ambidexterity literature.

Finally, the study indicates that the pursuit of opportunities (explorative search tasks) does not always hinge on creating a loose, isolated organizational context, as suggested in previous studies. Rather, careful planning and the utilization of exploitative routines can support exploration while maintaining exploitation.

The case study approach limits the possibility of generalizing the findings of this study. The method was chosen here to be able to concentrate on micro-level activities. Therefore, a fruitful avenue for future studies would be to attempt to scan larger populations of organizations for the behaviors here identified.
References


