

ASSESSING THE CONDITIONS FOR DISSEMINATION OF END-USER AND PURCHASER KNOWLEDGE IN A MEDTECH CONTEXT

Carl Wadell, Margareta Norell Bergendahl

IPD, School of Industrial Engineering and Management, KTH, Royal Institute of Technology, Sweden

ABSTRACT

A challenge for many medical technology companies acting in a business-to-business (B2B) context is to develop innovative products that satisfy the sometimes differing needs and requirements of their end-users and purchasers. These companies have to exploit knowledge about both stakeholders in order to maintain an innovative edge. Research to date has largely focused on the acquisition of customer knowledge, in particular on formal methods to acquire customer knowledge in the search for new opportunities. Much less research has considered how companies acting in a B2B context handle and make use of end-user and purchaser knowledge internally. One fundamental prerequisite to disseminate and exploit knowledge about end-users and purchasers in a company is that employees carry out a continuous social interaction concerning these stakeholders. But what are the structures for these dual social networks concerning end-users and purchasers within a company acting in a B2B context? In this article we apply social network analysis to investigate, describe and compare the different patterns of social interaction of end-user and purchaser knowledge in a business unit within a large medical technology company acting in a B2B context. A survey questionnaire was designed and sent out to 115 employees within the business unit, resulting in 86 valid responses (response rate 75%). The aim of the survey was to map how conversations about end-users and purchasers had occurred within the organization over the last three years. The results indicate large differences, both in structure and content, between the social interaction concerning end-users and purchasers. Based on these findings, we argue that medical technology companies acting in a B2B context can, by adapting their approach to the way they communicate end-user and purchaser knowledge, release untapped potential to increase both their innovation performance and their competitive advantage. We conclude with suggested directions for future research on this topic.

Keywords: Customer knowledge, internal communication, medical technology, social network analysis, product innovation engineering

1 INTRODUCTION

Previous research has revealed that the end-user often plays an important role in the development of new medical technology [1]. The end-user of medical technology is composed of healthcare professionals, patients, careers, as well as professionals allied with healthcare - all with different needs and requirements [2]. Knowledge about the end-user may reduce uncertainty by providing product developers with a more accurate picture of user requirements [3] and increase inter-unit agreement [4]. A lack of knowledge concerning end-users' needs and requirements in new product development often leads to significant problems in the commercialization phase [5]. When assessing a new product the end-user is mainly concerned with clinical performance, patient safety, usability and compatibility with current equipment. However, many medical technology companies acting in a B2B context also have to consider the needs and requirements of the purchaser. In most cases the purchaser will either be a head of clinical department or a centrally located procurer at a hospital or regional department. Previous research indicates that the properties most sought after by the purchaser in a new product might not be the same as (or may even be at odds with) those properties required by the end-user [6]. From the purchaser's point of view, the health economic aspects of a new product are crucial. They will consider whether a new product will (1) reduce or increase the unit cost per treatment, (2) expand or reduce the treatment population, (3) reduce or increase the risk of complications, (4) require repetitive use or eliminate the need for further treatment, and (5) improve or complicate the patient's

quality of life [7]. There are also other value dimensions that the purchaser will have to consider when buying a new product such as product quality, service and support, delivery, provider know-how, time to market, personal interaction, direct product costs, and process costs [8]. This situation creates an inevitable challenge for companies: How can they create, disseminate and exploit knowledge so that they will develop products that satisfy the needs and requirements of both these stakeholders? This could be taken as an easy shot, simply focusing the development on satisfying the needs of the purchaser that pays for the product. However, buying decisions by purchasers are often highly influenced by the end-users of the new product [9]. Moreover, simply focusing the development on reducing the price of current products or only implementing “me-too” ideas from competitors required by purchasers will probably not create long term competitiveness for companies. Another reason for companies to develop knowledge about purchasers is a growing global trend that purchasers, irrespective of their local healthcare system, are given a more strategic role in the acquisition of new medical technology. For instance, in the UK initiatives are undertaken to make governmental purchasers “smarter customers”, where stimulating private sector innovation is a central theme [10].

To date researchers have made attempts to further understand how the acquisition and exploitation of customer knowledge can be managed within product developing organizations. A certain research focus has been on more formal methods to acquire customer knowledge in the quest for new business opportunities [11]. However, much less research has considered how companies acting in a B2B context handle and exploit end-user and purchaser knowledge internally. In this article we apply a more fine-grained perspective on the exploitation of customer knowledge, focusing on the internal social interaction regarding end-users and purchasers within a product developing organization.

2 INTERNAL COMMUNICATION OF CUSTOMER KNOWLEDGE

In this section we provide an introduction to internal social interaction and communication regarding customers and why it matters in new product development. It is well known that a company can increase its internal knowledge base by bringing in external knowledge in order to generate new products and innovate. Internal social interaction and communication plays an important role in the dissemination and exploitation of this external knowledge. Internal social interaction and communication regarding customers contributes to a shared understanding of the customer’s preferences, reducing uncertainty and ambiguity in new product development [12].

For these reasons, new-product development teams are more successful if their members communicate with one another. Sharing information on customer needs and segments between marketing, R&D, engineering and manufacturing increases the likelihood of product success [13]. But this communication is often surprisingly difficult to obtain. One explanation of why communication fails is that different groups have different “thoughtworlds” – R&D employees speak a technical language and respond to an engineering culture of problem solving. Marketing people speak another language, hopefully that of the customer, and operate in a customer-oriented culture [13]. Other barriers are mismatching personalities, organizational and physical barriers [14]. Moreover, it is argued that the degree of communication for which a company should strive depends on the organization’s strategy and the perceived environmental uncertainty within which the company operates [14]. The more uncertain the environment is and the more the company’s strategy targets leading edge technology (which is riskier), the higher the need for integration between Marketing and R&D. Moreover, in the specific case of customer knowledge, there are scholars that argue that listening too much to the customer might hamper the innovation potential in an organization. In particular, current customers experiencing satisfaction with existing solutions may provide information that misleads companies in their search for new opportunities [15].

But how can we understand the context where companies have to handle and exploit dual streams of customer knowledge? Knowledge breadth (which refers to the number of different knowledge domains a company is familiar with) offers one perspective from which to understand this phenomenon [16]. Broad customer knowledge can be contrasted to deep and specific customer knowledge. Previous research shows that a breadth in knowledge about the market has a positive effect on innovation performance, but that it is also important for this knowledge base to include deep and specific market knowledge [16]. However, this broad knowledge base may also hamper the

dissemination and recombination of customer knowledge due to the knowledge held being heterogeneous between individuals, resulting in overly complex knowledge transfer [17]. Another important aspect is the informal organization of companies. Much of the recent organizational research shows that knowledge work such as R&D really gets done through the informal rather than through the formal organization [18]. For this reason we intend to investigate the social interaction (both formal and informal) that facilitate the dissemination and exploitation of end-user and purchaser knowledge by applying a social network analysis.

3 SOCIAL NETWORK ANALYSIS

A social network perspective allows us to view how actors within an organization are linked to each other through socially oriented relationships. In this case, who is talking to whom about end-users and purchasers? These relationships are frequently referred to as ties. Social network analysis (SNA) is the method applied to analyze these relational networks. SNA has previously been applied to analyze informal networks of knowledge sharing [18]. As mentioned, these studies show how work really gets done, by incorporating both informal and formal relationships in an organization.

In research on social networks, some researchers have focused on the mere presence of relational ties [19], while others have also considered the strength of those ties [20]. The strength of ties can for instance be described as the frequency of interaction between individuals [21]. Strong ties are associated with reciprocal arrangements in which advice and help flows in both directions between two individuals [22]. Repeated partner-specific ties have a stronger effect on knowledge accumulation than repeated technology-specific or repeated general experience ties [23]. Furthermore, the more uncertain a problem or opportunity is, the more desirable it is to have higher frequency and informality in communication patterns [24]. However, as mentioned, there is a need for a “common stock of knowledge” to smoothly transfer the knowledge needed for innovation through the networks linking individuals and groups. One line of argument in social network theory is that distant and infrequent relationships (i.e. weak ties) are efficient for knowledge creation because they provide access to more novel information by bridging otherwise disconnected groups or individuals in an organization [25].

Moreover, it is argued that organizational units not tightly linked to other units are more adaptive because they are less constrained by the systems they are part of [26]. Thus, a weakly tied product development team may have a beneficial search position in the network by being connected to other subunits while, at the same time, escaping the penalties of being restrained by other parts of the organization. This organizational autonomy is often considered positive for product innovation because the innovating unit is free from bureaucracy and other responsibilities that disrupt the product innovation task [26]. However, for some tasks it may be fortunate to be part of a denser network built up by more and stronger ties [27]. For instance, as product development teams frequently stand to benefit from knowledge residing elsewhere, they benefit from these connections to the rest of the organization. In product development this knowledge is often complex and strong ties provide better conditions for the transfer and exchange of complex knowledge [28]. There is an ongoing debate in innovation research about which type of structural and behavioral pattern constitutes the most beneficial conditions for individuals to innovate. Some research indicates that being in a so-called structural hole, bridging several other individuals who themselves are not connected to each other, is the most beneficial position [29]. Other research indicates that individuals who act so that they connect people who would otherwise be isolated from each other are more likely to innovate [30].

In sum, a challenge for companies acting in a B2B context is to develop products that satisfy the sometimes differing and contradicting needs and requirements of their end-users and purchasers. One possible explanation of why companies fail to do so could be a lack of internal communication regarding their end-users and purchasers. However, to date, there is a lack of research exploring this particular social interaction. We thus form the following research question:

RQ: How do the social interaction concerning end-users and purchasers respectively, differ within a medical technology company acting in a B2B context?

4 METHODOLOGY

This study is a part of a longitudinal action research project where representatives from healthcare, county councils, medical technology companies and academia have converged to learn more about how to collaborate within and between their organizations to increase each organization's innovation capability. As already mentioned a social network perspective was applied in this study in order to investigate and compare the social interaction patterns concerning end-users and purchasers. The research was conducted within a business unit in a large medical technology company with 115 employees allocated to eight different business functions: product development, marketing, sales, regulatory affairs, aftermarket, finance, operations and product application. The product applications group consisted mainly of nurses, doctors and clinical engineers employed by the company to provide clinical expertise in the product development projects. Moreover, the business unit was organized in a matrix organization, which means that employees moved around between different project groups. A product development project typically lasts for about six months.

4.1 Survey design

As previous research has shown that social interaction is a fundamental condition for knowledge transfer, we wanted to capture this phenomenon within the business unit. For this purpose a survey questionnaire was designed and used to collect data on the internal social interaction concerning end-users and purchasers. The respondents were asked to indicate with whom they had had conversations concerning the end-users and purchasers of the company's products during the last three years and how frequently these conversations had occurred on average. To accomplish this they were provided with a list of all the employees within the business unit for the past three years (during which time there had been almost no employee turnover). The frequency measures that were applied were "daily", "weekly", "monthly" and "yearly". If no interaction had occurred, respondents were asked to leave a blank. These questions were modifications of similar questions used in other social network analysis studies [31]. In line with previous studies on social networks, we were able to assume that frequency of interaction is a rough measurement of tie strength [21]. A paper questionnaire was handed out to all employees via their managers and 86 people completed the survey (a response rate of 75%). Compared with other similar studies this response rate can be considered as acceptable [32]. To ensure inner validity of the survey it was fundamental that the respondents understood the terms "end-user" and "purchaser". For this reason a brief description of these two stakeholders was provided in the introductory letter circulated with the survey. This description was developed in collaboration with the marketing department at the company. End-users were defined as national and international doctors, nurses, researchers, bio-engineers and family members. Purchasers were defined as national and international procurers at hospital and heads of clinical departments. Moreover, a pre-test with evaluation interviews was conducted with a group of five employees to make sure that the questions and definitions were understandable. Three of these individuals also took part in the final survey.

4.2 Processing of social network data

The knowledge networks were created in UCINET 6.286 Network Analysis Software [33]. First we manually entered the results from the network survey into Excel, removing all names that did not partake in the survey. Finally we ended up with two 86 by 86 matrices, one for end-user interaction and one for purchaser interaction. After that the matrices were imported from Excel to UCINET and transformed into a UCINET file format. To be able to check the reciprocity of the end-user and the purchaser interaction, both matrices were transposed using the transpose function in UCINET. The strong and weak ties were created by performing several Boolean combinations between the original matrices A and the transposed matrices A^T to get the final matrices B (i.e. if i,j (A) equals x and j,i (A^T) equals x than i,j (B) will be 1). However, as the measures covered a long period of time we assumed that two people who had interacted with each other during this time could have a slightly differing opinion about how frequently this interaction had occurred. For this reason we accepted that there was a mismatch of one frequency measure (i.e. if one person indicated a daily interaction but the other person indicated a weekly interaction a tie was generated). Moreover we considered daily and weekly interaction as a strong tie and monthly and yearly interaction as a weak tie. However, if one person indicated a weekly interaction and the other person indicated a monthly interaction we counted this as a strong tie. Finally, the accumulated matrices were united and visualized in NETDRAW [34]. In social network analysis studies, checking the reciprocity of ties is also a way to check reliability [32].

The reciprocity for strong ties was 75% concerning end-users (out of 218 indicated interactions), and 49% concerning purchasers (out of 78 indicated interactions). The reciprocity for the weak ties was lower: 33% concerning end-users (out of 901 indicated interactions), and 22% concerning purchasers (out of 358 indicated interactions). However, previous research suggests that reciprocity is most interesting for strong ties simply because these ties are much more likely to be reciprocal [35]. Moreover, in social network analysis it is assumed that about half of what people report about their own interactions is incorrect in one way or another [29]. This indicates that our result poses a decent reliability. To further ensure that the research result represented reality, the generated network diagrams were shown to the management team at the company who confirmed that this picture correlated with their pre-conceived ideas about how employees interacted when considering end-users and purchasers.

5 RESULTS

The results of the study are presented in the social network diagrams below, illustrating different social interaction schemes: (1) communication networks concerning purchasers (both strong and weak ties), (2) communication network of strong ties concerning end-users, and (3) communication network of weak ties concerning end-users.

5.1 Purchaser communication networks

Figure 1 illustrates the social interaction concerning purchasers. The nodes in the diagram are those members within the business unit with reciprocal strong ties (left) and weak ties (right). The lines illustrate that both nodes agree they have had more or less frequent purchaser-related conversations during the last three years. 16% (n=14) of all respondents had frequent reciprocal purchaser-related social interaction (i.e. strong ties). This implies that most of the respondents had never had a conversation regarding the purchaser during the last three years (or had indicated non reciprocal conversations). Considering the interaction between the market oriented groups (marketing, sales and product application) and the development department, there is only one person (node 75) in the development department who has a frequent purchaser-related social interaction with someone (node 10) in marketing. Considering the less frequent social interaction (i.e. weak ties) there are six people in the development department who are linked to the more market oriented groups (nodes 54, 68, 76, 39, 63, and 44). There are two individuals within the development department (node 54 and 63) who have more than one reciprocal tie to the market oriented groups. The results indicate that there is almost no purchaser-related social interaction within the development department, where only two people (nodes 60 and 63) are linked by a weak tie. There are a limited number of individuals within the more market oriented departments that do partake in purchaser-related social interaction (nodes 9, 10, 12, 20, 26, and 29). There is only one person (node 10) who has reciprocal purchaser-related social interaction with more than one person in the development department. The result indicates that there is a “core” of individuals in the marketing group and the product application group that have frequent conversations about purchasers. But the networks are fragmented within this core group, and there are only a few individuals who possess brokerage positions between the groups (nodes 7 and 20). What is noteworthy is that the sales department does not have any direct links to the product development department.

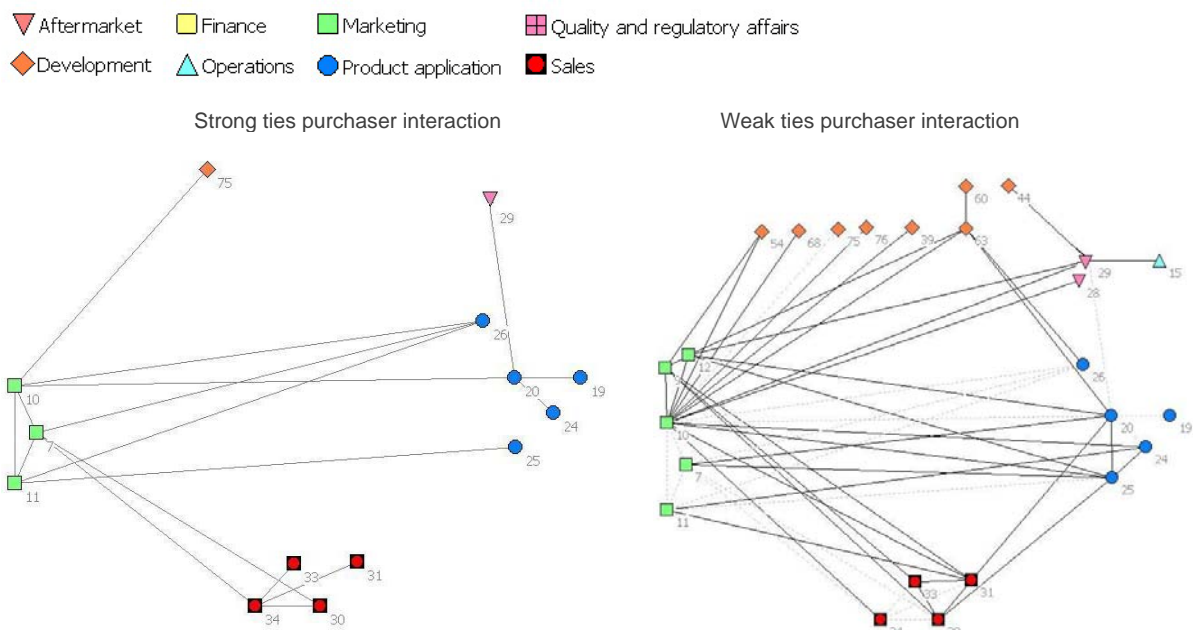


Figure 1. Communication networks concerning purchasers: strong ties (left) and weak ties (right) (strong ties as dotted lines)

5.2 End-user communication networks

The network of strong ties concerning end-user interaction is shown in Figure 2, and the network of weak ties in Figure 3 (strong ties are dotted lines). 50% (n=43) of all respondents had strong reciprocal ties concerning end-user interaction. Findings indicate that there are nine people in the product development department with frequent end-user-related interaction with people in the marketing department and the product application group. Of these nine people, five also have frequent conversations regarding the end-user with at least one other colleague within the development department (nodes 37, 43, 62, 64, and 75). There are a further nine people who only have frequent end-user-related conversations with other colleagues within the development department. However, it seems that most of these individuals are also connected to the market oriented groups via weak ties. There is another group of individuals within the marketing department with several weak links to the market oriented groups, but with deficient links to colleagues within the development department (nodes 38, 44, and 74). In contrast to the purchaser-related interaction, there seems to be several different roles regarding end-user interaction. These roles could be defined as internal stars, external stars and boundary spanners. There are a large number of strong ties between the marketing group and the product application group. However, in contrast to the purchaser interaction there are also individuals within the development department (nodes 37, 43, and 63) that are included in the “core” group of end-user interaction.

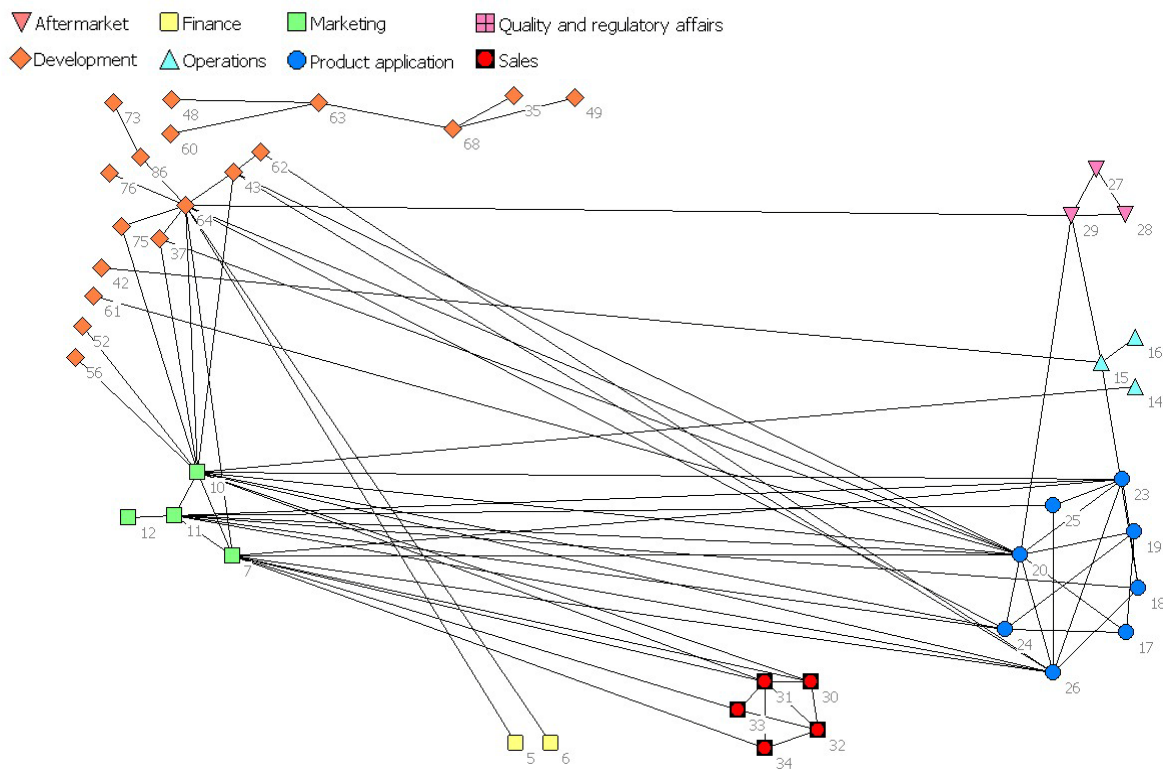


Figure 2. Communication network of strong ties concerning end-users

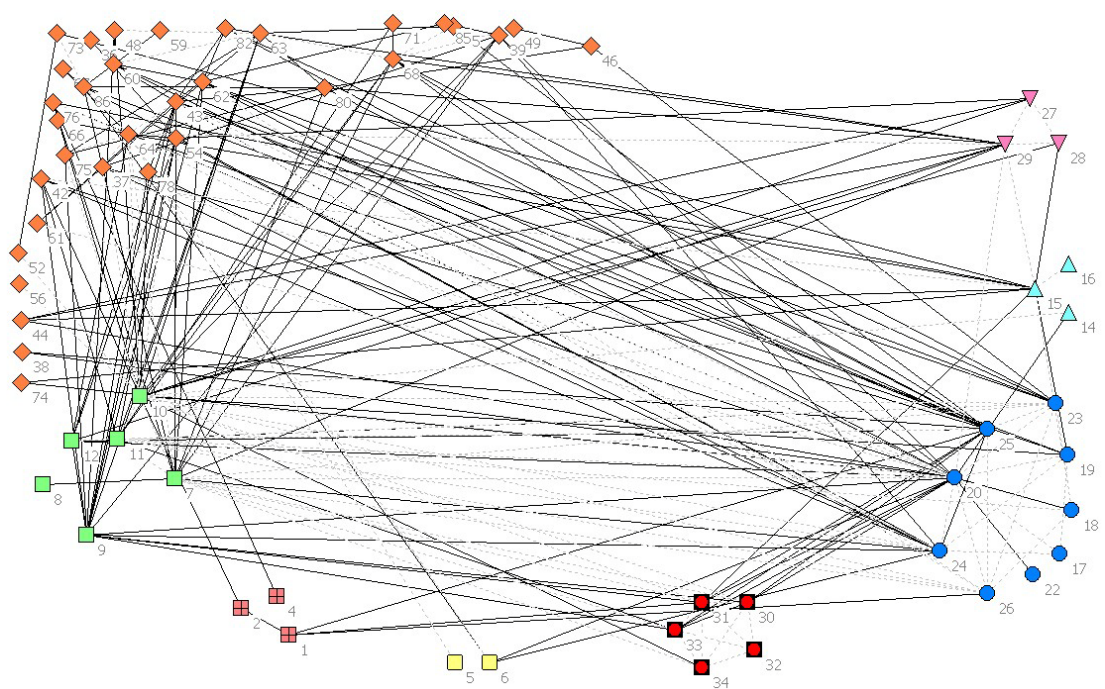


Figure 3. Communication network of weak ties concerning end-users (strong ties as dotted lines)

6 ANALYSIS

The results indicate that there are large differences in the communication patterns within the business unit regarding end-users and purchasers. Overall, the business unit seems to have a better ability to communicate about the end-user than the purchaser. The structural differences are displayed by the differing number of people who take part in end-user and purchaser conversations, the differing number of strong and weak ties, and the social interaction between departments being much higher in relation to end-users than to purchasers. Strong tie reciprocity was 75% for end-user conversations but only 49% for purchaser conversations, indicating a larger inter-unit agreement about what constitutes a conversation about end-users than there is about purchasers, and how frequently these conversations occur. Not so surprisingly, the more market oriented groups (marketing, product application and sales) tend to communicate more about end-users and purchasers than the development department. However, the results show that employees within the development department have much more communication regarding their end-users than their purchasers. Communication about purchasers is almost non-existent within the development department. Presupposing that frequent internal social interaction regarding customers is a prerequisite to grow customer knowledge, we can assume that the conditions for organizational learning regarding purchasers are insufficient in the business unit. Another observation is that the communication networks of end-user knowledge are denser and less dependent on certain individuals to connect different groups than the purchaser communication networks. Looking closely at the purchaser network, there are two nodes (numbers 10 and 20) that are located in a structural-hole position communicating frequently with several people within their own and other groups who do not communicate with each other about purchasers. Removing these two individuals would split up the purchaser networks and take away a lot of the communication links regarding purchasers between the different groups. Viewing the end-user network we can see that there are very few people, especially in the product development group, with more than one frequent reciprocal interaction with a peer. Moreover, there are no constellations of more than two people within the product development department that have had frequent reciprocal conversations about the end-users. This differs from the more market oriented groups, where the employees tend to have a frequent reciprocal communication considering end-users with many different colleagues. There are a limited number of product developers who are involved in this frequent communication regarding end-users with the more market oriented groups. The majority of the communication regarding end-user between the market oriented groups and product development is constituted by weak ties. Also the communication within the product development department regarding end-users is mostly constituted by weak ties.

7 DISCUSSION AND CONCLUSIONS

This study was initiated when medical technology industry reported on developing innovative products that had been favorably received by their end-users but were ultimately difficult to sell. They experienced that the purchaser valued their offering differently than the end-user did, and were thus concerned that the business unit may lack the capability to disseminate and exploit knowledge about both end-users and purchasers in their new product development process. One fundamental aspect in this capability is the internal communication about end-users and purchasers. If there is no social interaction concerning these stakeholders it is not likely that valuable knowledge will be disseminated and exploited. Therefore in this explorative study we investigated and compared the internal communication patterns regarding end-users and purchasers. The results indicate that there are large differences in the communication networks regarding these stakeholders. But what does this result tell us and what does it add to theory? Problems and barriers in the communication of customer needs and requirements between departments are not a new phenomenon [18]. However, our results reveal that we have to apply a more fine-grained perspective when we discuss internal communication of customer knowledge within companies acting in a B2B context. Previous research has shown that broad market knowledge has a positive effect on the innovation performance of companies [20]. Based on this result an improved communication around purchasers would broaden the market knowledge and improve innovation performance. On the other hand, too much communication about purchaser's needs and requirements might restrict creativity in new product development. Thus, the correlations between internal communication of dual customer knowledge and innovation performance requires further research. However, based on these findings, we argue that medical technology companies

acting in a B2B context may, by adapting their approach to the way they communicate different types of customer knowledge, gain access to previously untapped potential, increasing both their innovation performance and their competitive advantage.

8 LIMITATIONS AND FUTURE RESEARCH

First, a limitation of this particular study is the fact that it is based solely on one case study of one business unit within one company. It is thus difficult to assess how representative the findings are for other industries and business units. For the purpose of generalization, future research should examine multiple R&D groups in different industries and cultural settings. Secondly, our study considered the frequency of interaction in order to identify social interaction concerning end-users and purchasers. Thus, we asserted that social interaction is a precondition for knowledge dissemination. However, the approach does not consider whether the social interaction really contributed to the knowledge creation or dissemination. Neither does it tell us anything about the usefulness of the communication. Future studies should incorporate measures of knowledge creation and usefulness in order to identify the most valuable interactions. Moreover, we also have to understand more about how the duality of customer knowledge influences the innovation performance of individuals and companies. Finally, it would be interesting to further investigate the barriers related to organizational learning with regards to end-users and purchasers within medical technology companies - especially the organizational barrier for knowledge creation concerning purchasers.

ACKNOWLEDGEMENT

The Product Innovation Engineering program (www.piep.se), a Swedish research and development program for increased innovation capability in organizations, is gratefully acknowledged for having made this work possible.

REFERENCES

- [1] Biemans W.G. User and third-party involvement in developing medical equipment innovations. *Technovation*, 1991, 11(3), pp.163-182.
- [2] Shah S.G.S. Robinson I. User involvement in healthcare technology development and assessment: Structured literature review, *International Journal of HealthCare Quality Assurance*. 2006, 19(6), pp.500-515.
- [3] Ives B. and Olson M. User involvement and mis success: a review of research. *Management Science*, 1984, 30(5), pp.586-603.
- [4] Lind M.R. and Zmud R.W. The influence of a convergence in understanding between technology providers and users on information technology innovativeness. *Organization science*, 1991, 2(2), pp.195-217.
- [5] Cooper R.G. Project NewProd: Factors in new product success. *European Journal of Marketing*, 1980, 14, pp.272-292.
- [6] Gummesson E. *Total relationship marketing*, 2008 (Elsevier Ltd, Oxford, Third edition)
- [7] Goldsmith J. The Impact of New Technology on Health Care Costs. *Health Affairs*, 1994, 13(3), pp.80-81.
- [8] Ulaga W. Capturing Value Creation in Business Relationships: a customer perspective. *Industrial Marketing Management*, 2003, 32(8), pp.677-693.
- [9] Wind Y. and Robertson T.S. The Linking Pin Role of Organizational Buying Centers. *Journal of Business Research*, 1982, 10, pp.169-184.
- [10] Department of Trade and Industry. *Department of Trade and Industry five year program – Creating wealth from knowledge*, 2004
- [11] von Hippel E. and Katz R. Shifting innovation to users via toolkits. *Management Science*, 2002, 48(7), pp.821-833.
- [12] Kyriakopoulos K. and de Ruyter K. Knowledge Stocks and Information Flows in New Product Development. *Journal of Management Studies*, 2004, 41(8), pp.1469-1498.
- [13] Dougherty D. Interpretive barriers to successful product innovation in large firms. *Organization Science*, 1992, 3(2), pp.179-202
- [14] Griffin A. and Hauser J.R. Integrating R&D and Marketing: A Review and Analysis of the Literature. *Journal of Product Innovation Management*, 1996, 13, pp.191-215.
- [15] Christensen C.M. *The innovator's dilemma: When new technologies cause great firms to*

- fail*, 1998 (Boston, MA: Harvard Business School Press.)
- [16] de Luca L. M. and Atuahene-Gima K. Market Knowledge Dimensions and Cross-Functional Collaboration: Examining the Different Routes to Product Innovation Performance. *Journal of Marketing*, 2007, 71, pp.95-112.
 - [17] Galunic D.C. and Rodan S. Resource Recombinations in the Firm: Knowledge Structures and the Potential for Schumpeterian Innovation. *Strategic Management Journal*, 1998, 19(12), pp.1193-1201.
 - [18] Cross R. Prusak L. Parker A. and Borgatti S.P. Knowing what we know: supporting knowledge creation and sharing in social networks. *Organizational Dynamics*, 2001, 30(2), pp.100–120.
 - [19] Burt R. *Structural holes: The social structure of competition*, 1992 (Cambridge: Harvard University Press.)
 - [20] Granovetter M.S. The Strength of Weak Ties. *The American Journal of Sociology*, 1973, 78(6), pp.1360-1380.
 - [21] McEvily B. and Zaheer A. Bridging ties: a source of firm heterogeneity in competitive capabilities. *Strategic Management Journal*, 1999, 20(12), pp.1133–1156.
 - [22] Marsden P.V. and Cambell K.E. Measuring Tie Strength. *Social Forces*, 1984, 63(2), pp.482-501.
 - [23] Zollo M. and Winter S.G. Deliberate Learning and the Evolution of Dynamic Capabilities. *Organization Science*, 2002, 13(3), pp.339-351.
 - [24] Gupta A.K. and Govindarajan V. Knowledge Flows and the Structure of Control within Multinational Corporations. *Academy of Management Review*, 1991, 16(4), pp.768-792.
 - [25] Weick K.E. Educational Organizations as Loosely Coupled Systems. *Administrative Science Quarterly*, 1976, 21(1), pp.1-19.
 - [26] Daft R.L. Bureaucratic versus non- bureaucratic structure and the process of innovation and change. *Research in the Sociology of Organizations*, 1982, 1, pp.129-166.
 - [27] Coleman J.S. Social Capital in the Creation of Human Capital. *The American Journal of Sociology*, 1988, 94, pp.95-120.
 - [28] Hansen M.T. The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organization Subunits, *Administrative Science Quarterly*, 1999, 44(1), 82-111.
 - [29] Burt R.S. Structural holes and good ideas. *The American Journal of Sociology*, 2004, 110(2), pp.349-399.
 - [30] Obstfeldt D. Social Networks, The Tertius of Iungens Orientation, and Involvement in Innovation, *Administrative Science Quarterly*, 2005, 50(1), pp.100-130.
 - [31] Garton L. Haythornthwaite C. and Wellman B. Studying Online Social Networks. *Journal of Computer Mediated Communication*, 1997, 3(1)
 - [32] Wasserman S. and Faust K. *Social Network Analysis*, 1994 (Cambridge: Cambridge University Press.)
 - [33] Borgatti S.P. Everett M.G. and Freeman L.C. *Ucinet for Windows: Software for Social Network Analysis*, 2002, (Harvard, MA: Analytic Technologies)
 - [34] Borgatti S.P. *Netdraw Network Visualization*, 2002 (Analytic Technologies, Harvard, MA)
 - [35] Bernard H.R. Killworth P.D. Kronenfeld D. and Sailer L. On the Validity of Retrospective Data: The Problem of Informant Accuracy, *Annual Reviews in Anthropology*, 1985, 13, pp.495-517.

Contact: Carl Wadell
 School of Industrial Engineering and Management/KTH, Royal Institute of Technology
 Integrated Product Development
 Brinellvägen 85, 100 44, Stockholm, Sweden
 Phone: 004687907895
 Email: cwadell@kth.se

Carl Wadell is a PhD student at Integrated Product Development, KTH, Royal Institute of technology Stockholm. Carl Wadell's research interest concerns customer driven innovation within the medical technology industry. Margareta Norell Bergendahl is Professor in Integrated Product Development, KTH, Royal Institute of Technology. Margareta Norell's research interest is strongly related to work procedures for efficient co-operation and leadership in industrial product development processes.