NORTH-HOLLAND

Available online at www.sciencedirect.com
SCIENCE DIRECT®

Industrial Marketing Management 33 (2004) 75–86

INDUSTRIAL MARKETING MANAGEMENT

Internetworked after-sales service

Peter Zackariasson[a,1], Timothy L. Wilson[b,*]

[a]Umeå School of Business and Economics, Center for Digital Business, Umeå University, S-901 87 Umeå, Sweden
[b]Umeå School of Business and Economics, Department of Business and Economics, Umeå University, S-901 87 Umeå, Sweden

Received 30 December 2001; received in revised form 30 December 2002; accepted 6 January 2003

Abstract

Firms, even ones in relatively heavy industries, seem to be moving in a direction in which information technology (IT) is becoming more and more integrated into their organizations. This paper describes a good, perhaps model, firm that appears to be getting better by recognizing IT per se as an actor in its after-sales organization. Both a smarter product and IT produced evolutionary changes in its after-sales operations. As the product becomes self-diagnostic, it is increasingly evident that the technology is an actual participant in the organization. These developments are interpreted in terms of internetworking concepts. Perhaps one outcome of this study will be to encourage leaders/managers to utilize some of the precepts of actor network theory (ANT) in their thinking.

Keywords: After-sales service; Technology; Capital goods; International distribution; Actor network

1. Introduction

Technology changes things, e.g., products, production, and communication. Traditionally, it has been concluded that technological progress is the main driver of economic growth, and innovative ideas that collectively constitute technological progress have most often involved the profit-driven actions of firms (Hunt, 2000, p. 209). Most recently, widespread changes in industry as a consequence of information technology (IT) have been noted. Not only have the elements of production been changed, but also the way business is transacted has been affected. Somewhat as a consequence of observed changes, it is now recognized that technology has the possibility to change organizations themselves. It has been suggested that technology is an actor itself in these organizations (Latour, 1987). In this recognition, technology's full potential can be exploited.

Presently, one of the areas most sensitive to these changes may be the area of after-sales service provision, especially among those international firms that provide these services through distribution networks. It has been noted that forward-looking companies have attempted to make their distribution channels more flexible and adaptive (Narus & Anderson, 1996). That is, firms must link manufacturing, service, and distribution functions to meet customer needs, and the "winners" will be those firms that develop innovative solutions to providing those links that best satisfy their customers' needs. In this regard, provision of after-sales services through these "webs of capabilities" (Narus & Anderson, 1996) is one way that firms can differentiate themselves from competitors (Porter, 1980). Indeed, the provision of these services is important in terms of expectations (Levitt, 1983), profitability (Herbig & Palumbo, 1993), and customer loyalty (Smith, 1998).

The purpose of this article is to review changes that are occurring in one firm's after-sales service practices in terms of internetworking. One expects reactive changes in technology in IT firms because of the rapidity with which that industry has changed. This firm, however, was in a relatively heavy industry, but technology changed the organization nevertheless. The firm had been studied previously (Wilson, Boström, & Lundin, 1999), so this paper assumes aspects of a longitudinal study. At the time of the initial study, the firm was doing well. It was not one of the "adaptive channel" firms cited by Narus and Anderson (1996), but it well might have been. Thus, it was a good firm, which appeared to be getting better. The paper thus should be of interest to individuals who are concerned with

* Corresponding author. 100 Locust Lane, Indiana, PA 15710, USA. Tel.: +1-724-349-5473.
E-mail addresses: Peter.Zackariasson@fek.umu.se (P. Zackariasson), timwilsonxx1@hotmail.com (T.L. Wilson).
[1] Tel.: +46-155-266602 (home), +46-70-7197171 (mobile).

0019-8501/$ – see front matter © 2003 Elsevier Science Inc. All rights reserved.
doi:10.1016/S0019-8501(03)00019-1

technology's impact on organizations—specifically where technology either is becoming, or may become, an actor itself. Marketing academics might like the paper as a case study in service distribution transition under technological influences; practitioners, on the other hand, may find it useful as a model to guide expectations.

2. Background

2.1. Capital goods (heavy equipment) and after-sales services

Capital goods of course are used in the production of other products and are purchased as investments. Understanding the production and distribution of these products is as much associated with the understanding of economics and finance as it is with marketing. That is, they tend to have different tax treatments, budgets, and buying behavior than other items that go into the production of goods and services (see, for instance, Haas, 1995, p. 18).

In general, the production and distribution of these products is fraught with difficulties. There appears to be more ways to lose than there are to win, and in fact, many companies have disappeared from the competitive landscape for these products over the past 20 years. First, the demand for these products tends to be cyclical. Cycles that exist in the end market are emphasized in the demand for production equipment because sales tend to be lumpy in scale-up for demand. Additionally, suppliers may find themselves competing with their own products. A used piece of equipment can be a good substitute for a new item, and frequently, strong secondary markets for production equipment exist, which accentuates cycles for original equipment even more. Second, items tend to be one-time purchases that result from competitive bids. Consequently, there is downward pressure on prices for products that frequently are end-user customized. In this regard, transportation costs can be high for these items, which may have implications on the geographic area in which companies can compete. Further, because of the one-time nature of these purchases, good reputations take some time to establish. News of problems, on the other hand, travels fast. Finally, investment-to-sales ratios tend to be high in these industries. Firms have little choice in making these investments, however, if they are to remain competitive themselves. In particular, continued investment in product as well as production development is required in order to bring competitive products to the marketplace.

It was in this type of business environment the firm in question competed. It served 50+ countries from its northern Swedish location through a network of subsidiaries and distributors.

During its more than 50-year history, it had been able to carve a niche for itself by producing a product that had an engineering superiority over its competition. "Superiority" in this sense dealt with not only durability of the product, but safety as well. The equipment was used in the transportation of both personnel and materials, so user-customers recognized its value—at least when it was nonoperational.

The "secret" of success in competitive situations such as this is well known in principle. Porter (1980) has suggested that there are two ways that a firm can succeed relative to its competitors—either become the low-cost producer or develop a sustainable differentiation of the firm's product. The study firm had developed its differentiation along three lines. First, it had the superior product, but this position was becoming more difficult to sustain. Even though the company continued to improve and upgrade its product line, other firms found it advantageous to copy its products. Secondly, it had its distribution system. This system played a vital role in the firm's continual success because there were identifiable differences in both expectations and communication patterns of the company's end-users (Wilson et al., 1999). By working through distributors, the firm was able to stay attuned with its end-users in spite of these differences by utilizing the understanding of the local representatives. Finally, the firm supplied exceptional after-sales service through this system and independent facilitators. Although not listed as an example of a firm utilizing "adaptive channels" by Narus and Anderson (1996), it would seem the firm's operations fit those criteria. In other words, it supplied not only routine service, but also met exceptional demands through its distributors in an expedient manner. The firm not only had a flexible inventory system in which parts could be transported from a number of sources in its distribution chain, it had flexible personnel as well. That is, in an emergency, if the closest competent person were located with a distributor or subsidiary, it would be that person who could be called upon to complete a job.

In relationship to these advantages, after-sales service was especially important in the company's business. It not only helped to differentiate the product and thus present some advantage in initial selection, it was also important in the sale of replacement parts. Suggestions of service personnel carried high credibility. If, for instance, one of them suggested replacement of a component, users usually accepted that recommendation—the downside risks of subsequent breakdown and lost operations were too great to not do so.

With the recognition of both the strategic and financial importance of after-sales services in the business, attention turned toward improving it. Early on, qualified, independent service providers were added to the distribution channels and attempts were made to adopt best practices in the three major international segments the company served (Wilson et al., 1999). Both additions tended to provide responsiveness in the system. The adoption and improvement of IT throughout the channel suggested further improvements were possible. One vexing problem was "lost" units. That is, the units were somewhat portable; they could be taken down and moved. With the presence of a secondary market and the purchase of units for rental, the company was unable

to maintain location of all units. In this regard, there was a safety component in each unit that required periodic inspection. That component "never" failed, but its presence was essential in fail-safe operation. In some markets, its inspection was mandated by regulation, and visits were provided on a regular basis, but in others, the user/system bore this responsibility. Component failure not only exposed the company to liability possibilities, but inspection provided access to inspection of other components in the unit and replacement if necessary. The lack of knowledge of the location of some units precluded this possibility.

3. Technology and service

The application of technology to service provision is not new. Grönroos (1983), for instance, described a dual delivery service model that included both a personal and a technological component. The new appreciation, however, is the observation that the adoption and use of IT may change not only the nature of the service delivery, but service organizations themselves.

Traditionally, technology such as IT has been looked upon as an external and objective force, a determinant on organizational properties, such as structures and work procedures (Carter, 1984; Davis, 1989; Foster & Flynn, 1984; Hiltz & Johnson, 1990; Leavitt & Whistler, 1958; Pfeffer & Leblebici, 1977; Siegel, Dubrovsky, Kierler, & McGuire, 1986). This perspective views technology as something that is imposed on the organization with the consequence that routines and work procedures are a result of the possibilities inscribed in the technology. In contrast to this rather technological deterministic perspective, research on human actions has emphasized the social construction of technology (Child, 1972; Davis & Taylor, 1986; Kling & Iacono, 1984; Markus, 1983; Perrow, 1983; Trist, Higgins, Murray, & Pollock, 1963; Zuboff, 1988). That is, the meaning of any technological artifact is created in the daily use of and interaction between humans and technology (see Table 1).

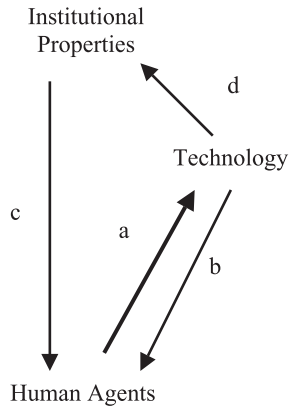
These two perspectives, technological and social deterministic, by themselves hinder the possibility of seeing the mutual interaction between humans and technology in general and in organizations specifically. Orlikowski (1992, 2000) used the concept of structuration theory (from Giddens, 1984) to "... reconstruct the concept of technology and to propose a model for investigating the relationship between technology and organizations" (Orlikowski, 1992, p. 403). By reconstructing the theory of structuration, Orlikowski presents a view of technology as both constraining and enabling in any organization, and thereby avoiding any technological or sociological dualism.

Technological embodiments or artifacts are the product of human action, which assume objective structural properties. This combination is referred to as the duality of technology. In other words, humans inscribing into technology structural features construct technological artifacts. These structures tend to become regarded as concrete things and institutionalized, losing their connection with their creators when in use. For the individuals using these technological artifacts, they appear to be objective structural properties of the organization. That is, "...many of the actions that constitute the technology are often separated in time and space from the action that are constituted by the technology, with the former typically occurring in vendor organizations, and the latter occurring in customer sites." (Orlikowski, 1992, p. 407) Put another way, when using technology, humans have structural constraints from what is inscribed into the technological artifact, but at the same time, they are able to redefine or change the use of any technology within its context.

The structuration model of technology (Fig. 1) consists of the following components: human agents, technological artifacts, and institutional properties of organizations (Orlikowski, 1992). First, a technological artifact is a product of human action. As described above, humans construct technological artifacts, and it is only through appropriation by agents that technological artifacts can be understood. Secondly, technological artifacts are at the same time a medium for human action. They are used by workers and mediate their actions. In this respect, technological artifacts restrict and enable interaction. Thirdly, human action is restricted by the institutional properties of the organization. When using any technological artifact, we draw on norms, knowledge,

Table 1
Background: evolving role of technology in organizations

Item	Interaction	Consequence
Traditional role of technology (e.g., Hunt, 2000, pp. 205–228)	Discovery–development–commercialization	Commercial exploitation produces enhanced profits for firms
Early picture of technology in organizations (e.g., reviewed by Orlikowski, 1992)	Dichotomy. Either (1) technology determined what individual did in organization, or (2) individual was master of technology and shaped technology to his/her will	Technology becomes facilitator in shaping what individuals and firms do. Productivity does not necessarily increase, but the scope of work and role of interaction with technology may shift
Evolving role of technology in organizations (e.g., postulated by Orlikowski, 1992)	An interaction occurs between the individual and technology. That is, both may change	Technology itself may become an actor in the organization. In other words, both individuals and technology play roles in the organization



Arrow	Type of influence	Nature of influence
a	Technology as a product of human action	Technology is an outcome of such human action as design, development, appropriation and modification.
b	Technology as a medium of human action	Technology facilitates and constraints human action through the provision of interpretive schemes, facilities, and norms.
c	Institutional conditions of interaction with technology	Institutional properties influences human in their interaction with technology, for example, intentions, professional norms, state of the art in materials and knowledge, design standards, and available resources (time, money, skills)
d	Institutional consequences of interaction with technology	Interaction with technology influences the institutional properties of an organization, through reinforcing or transforming structures of signification, domination, and legitimization.

Fig. 1. The dualistic nature of technology in organizations (from Orlikowski, 1992).

and resources in the existing organization. Finally, human action, when using technological artifacts, influences the institutional structures of the organization either by reconstructing or changing it.

This perspective of technology in organizations is becoming fairly widespread and commonly accepted, but the very important understanding that IT has both constraining and enabling implications is perhaps still underdeveloped. One theoretical framework that has provided a deeper understanding of the relationship between the social and technological artifacts is actor network theory (ANT) (Akrich, 1992; Akrich & Latour, 1992; Callon, 1991, 1994; Latour, 1987). An actor network consists of, and links together, both social and technical elements; in this network, there is no a priori distinction between the social and technological. It is at the same time not the static relationships between the elements that make up the network, but the processes or achievements in which actors are involved. Actors can be either human (one or many humans) or nonhuman (such as machines, doors, or even weights on hotel keys); all actors have the potential of initiating action, and all are co-creators of meaning in the actor network.

One might ask how is it that technology in ANT takes the form of an actor, instead of a mere tool? In an illustration used by Latour (1999) it is suggested that the interface between humans and technology might not be that obvious. "Guns kill people" is a slogan used by those individuals who may want to restrict the sale of guns. To this the National Rifle Association replies "Guns don't kill people; people kill people." The logic of the first standpoint is that of a materialist standpoint; the gun acts from its material virtue, independent of the person holding it. The latter argues that a gun consists of mere parts, neutral to the acts of killing. If the person holding the gun has criminal intentions, the gun plays no part in this intent. The illustration continues. Consider that when an artifact is created, certain functions are inscribed into it; that inscription means that each artifact has the potential to take hold of a passerby and force them to play a role in its story. What ANT suggests is that the "gunmen kill;" a person enlists the gun or is enlisted by it—it does not matter which—and a

third actor emerges from a fusion of the other two (person/gun). Latour argues that the goal of each actor has been translated into a third goal; instead of harming, the person/gun now kills. The responsibility of actions must therefore be shared between all actors, human and nonhuman.

Research using ANT as a basis is fairly rare in journals published in the US/North America; today, it is mainly a European representation. Since its appearance in social studies in the early 1980s, however, it has evolved and perhaps subtly transformed; the ANT concept currently used has been supplemented with an after, as in ANT and after. Calás and Smircich (1999), who define ANT as belonging to the "after" postmodernism, credit it for providing two issues for thought: "First, the actor and the network are not just things out there to be seen or appreciated by the researcher. Rather, the actor network is in itself the conceptual framework—a way of understanding social and technological processes. Second, thinking in networks requires conceiving of relationships among things in particular ways" (Calás & Smircich, 1999, p. 663).

Both the structuration model of technology and ANT incorporate technology as an important but neglected part of organizations. Nevertheless, how they incorporate technology differs. ANT argues that one should not study people on one side and technology on the other, but a network of actions with part human and part nonhuman actors (Latour, 1992). This approach means that the division technical–social is abandoned, and supplemented with a focus on actor networks. In contrast, the structuration model of technology views technology as a technological object, created by humans, thereby separating the social and technological and keeping the dichotomy.

A special set of technologies is used when "internetworking," which has application in this paper on after-sales service. Internetworking is a special case of IT and has been defined as the way of "...using special-purpose computers or hosts to connect a variety of separate networks for transmitting data, files and message in text, audio, video or graphic formats over distance" (Orlikowski, 1999, p. 7). That is, when Internet[2] is used to send e-mails or downloading data, internetworking is being practiced. Internetworking does not have to involve web pages, commonly associated with Internet, but Internet per se consists of a multitude of technological artifacts, hardware and software. All internet-based communications (including web-based catalogues) are included in the field of internetworking between the company and its customers. Further, although Internet is the largest platform for internetworking, the concept is not limited to Internet use exclusively. Many technologies may be used that enable work to proceed over time and space. A company, for instance, may use sensor applications for internetworking, still using the hardware that Internet is dependent upon, but not use web page software. Two advantages of internetworking are that it can be used globally and in an instantaneous response mode.

The arguments for implementing any technological application, not the least of which is internetworking, have often been analyzed from a productivity perspective. This type of approach has given rise to the productivity paradox. That is, despite all the investments made in technology, it has been difficult to correlate this investment with any increase in productivity (Brynjolfsson, 1993). This approach, however, is what Bergquist and Ljungberg (2000) refer to as the first-level effect of IT. The second-level effects are due to the changes affected in social relations, e.g., people pay attention to new things, come into contact with new people, and interdependencies between people change (Bergquist and Ljungberg, 2000, p. 66). The second-level effects may have more far-reaching implications in organizations. Nevertheless, at the same time, they produce more difficult, if not impossible, changes to anticipate. What is clear though is that the technological innovations that have enabled internetworking have made it possible to change work procedure and/or change relations between actors in any organization, whether they might be human or nonhuman.

4. Methodology

Case studies have been acknowledged as useful in the identification of important variables in situations in which there is little control over events in a real-world context (Aaker & Day, 1990; Bonoma, 1985; Green, Tull, & Albaum, 1988; Yin, 1994). In this regard, this paper is a continuation of a longitudinal study that was initiated in 1996 of the after-market practices of an international, niche-oriented capital goods company. From the beginning, the information used in the analyses of this firm derived from in-depth interviews of personnel involved in relevant areas of activity in the company (Wilson, 1999; Wilson et al., 1999). Thus, at the time the present study started, there were about 3 1/2 days of on-site interviews plus follow-up conversations and analyses.

The empirical information for the present paper came from an on-site, in-depth interview with the business area manager of after-sales. It was structured around a set of funnel-down questions designed to determine the extent to which (1) recent technological changes had been incorporated into the company's products and the way in which the products were being serviced, (2) the degree to which these changes could be characterized, and (3) the consequences of these changes. The interview itself was fairly informal. The respondent felt comfortable supporting his observations with a flip file of the company's most recent after-sales strategy, however, so immediate

[2] We follow the practice of workers in this area of dropping the "the" before "internet" and using the capitalized form, where Internet refers to the myriad of technologies enabling communication through electronic media.

substantiation of the observations cited here with "hard" evidence was possible. Prior agreement was made with the respondent on maintaining confidentiality, so company identification and especially financial results are not given in this paper.

5. Results

5.1. Firm's baseline situation

At the time the original study (Wilson et al., 1999) was made, after-sales services recently had become more important to the company in a strategic sense; they were one means for differentiating the company's offerings from its competitors. In an atmosphere that was becoming more competitive, the company on the one hand had turned to a practice of patenting new developments to provide relief from outright copying of its products by competitors. On the other hand, competitors had not yet been able to match that aspect of the company's service offering and in many instances, service was important to customers. Further, in a more operational sense, service sales as a percent of total sales were becoming more important for the firm. At the time that study was made, they represented 15–20% of total sales. This amount was thought to understate the importance of their contributions to the corporation because the presence of this capability "pulled through" sales of its equipment. That is, the acknowledged capability of providing this service was an important selling point of the company's distributors. The after-sales capability was also highly responsible for making sales of replacement parts. Customers relied heavily on the judgment of service technicians in ordering replacement and repair components. Their advice was generally taken, and their influence in establishing long-term relationships was recognized.

After-sales service was handled through the subsidiary/distribution network of the firm. Although firm employees still played a role in service provision, most of the service tasks were being devolved to the distributors. Because of the important role the company's product tended to play in user production, downtime was expensive. Thus, it was important to have field representative who could be on site in a minimum amount of time. In those sectors where response was critical, the network was "trimmed" by independent firms who served end-users of the product—and thus the company and its distributors. Service personnel from the company, its subsidiaries, and its distributors were utilized worldwide and a coordinator at corporate offices managed their activities. An essential, and critical, element of the firm's service strategy was corporate training. Thus, before a distributor or independent contractor could be authorized to service or inspect equipment, they had to have had the product training supplied at the centralized, northern Sweden office.

5.2. The evolving business situation

Over the 3 years between interviews, the competitive situation in the industry had become even more critical. New competitors had entered the company's product market segment and were providing close copies of the firm's products. Additionally, "close" competitors[3] were producing products that could provide much the same function as the company's products. Consequently, price pressure in the industry had made equipment sales a break-even type of business. Although sales had decreased in the Far East, they had picked up in North America, and net revenues had increased about 20% over the 3-year period. In the face of this situation, after-sales services took on even more importance. Whereas after-sales had been a function coordinated by marketing during the original interviews, it had become one of five separate functions in the organization, staffed by a Business Area Manager, reporting to the President-General Manager (MD in Sweden).

It was this after-sales manager who was the respondent in the interview. He indicated that it was expected that equipment sales would continue to be under competitive pressure. Further, although after-sales had remained at about 15–20% of total sales, line accounting indicated an attractive portion of profit came from this source. Thus, the company strategy for the present year was to "strengthen after-sales (in order) to strengthen the (company's) position in the market." This assessment was substantiated by the company's *Future Development* in its annual report, "Special efforts have been initiated in the after-sales field, where we are heavily increasing our investment in our global service and spare parts organization to create added value for our products, increased contact with end-users and utilization of the entire life of products to provide increased sales and profitability" (Company AB, 2001). The respondent indicated this statement of purpose was supported by two goals for after-sales, one qualitative and one quantitative. These goals had been communicated to after-sales personnel in the corporate network around the world:

1. to be the best on site (qualitative)
2. to increase after-sales revenues by 50% over a 3-year period (quantitative).

Some explanation is needed with regard to the first of these goals because the respondent indicated that it would perhaps be difficult to get a measure of this goal, thus, the "qualitative" denotation. It is a situation common to successful international niche firms who market through distributors. Associated with the company's dominance of its niche was the fact that it was already better in supplying after-sales service than its competitors. Nevertheless, as new

[3] Companies who were using similar technology to produce similar products, but who had not previously been supplying the company's user segment.

competitors entered its niche, or as comparisons were made in a broader target market, the company felt comparisons might be more stringent. Thus, there was a need to continually monitor comparable producers to insure that they were better in these comparisons. Further, judgments had a regional bias (Wilson et al., 1999) and also varied customer to customer. That is, "moments of truth" varied by individual customer and thus, the on-site designation. The company was therefore saying it was placing itself in a position of being "best" in the judgment of each customer in its international market.

The second goal, however, was measurable and appeared very doable in the estimation of the respondent; the company, in fact, would be likely to achieve this goal earlier than planned.

6. Incremental changes in service provision

Perhaps the most significant "common" change in technology in the corporate network organization since the original interviews was the change in communication mode. Previously, the FAX was fast enough to provide worldwide, next-day communication. It also provided "hard copy" that suited some of the engineering requirements in service (Wilson et al., 1999). Since that time, progress in communications had certainly improved capabilities, through the integration of IT in the organization. To a certain extent, these improvements tended to bring with them a certain impatience. That is, the knowledge that things can be done faster tends to bring with it faster service. In this case, the company had installed a 24/7 call center so that field representatives had access to a corporate representative on a 24-h basis, 7 days a week. Consequently, the company now produced timely (near instantaneous) response to emergency calls and repairs on a global basis (see Table 2).

Not only had response time been decreased, but also the breadth of support to field personnel had increased due to the same changes in communications technology. In this case, field representatives were encouraged to contact not only the corporate office, but also to call directly other field representatives. As an example, an engineer in Korea having a problem was not limited to calling the 24/7 number in Sweden, but he/she might call a service engineer in North America. Thus, service personnel on site had the capability to get expert assistance on site on a real-time basis. This ability was of particular importance as the products themselves got more sophisticated as a consequence of product improvements.

These two changes dealt with improvements in communication technology. There were, of course, other "smaller" things that had been done with communication that improved service. A spare parts catalog was produced that was picture oriented to transcend the many languages the company served. The master for this catalog was published on a homepage, so really parts service was becoming literally a click away. The fourth incremental improvement came from analysis of inventory logistics (see Table 2). The initial interview indicated the company kept track of the spare parts inventory that existed in the field—at its subsidiaries, distributors, and customers (Wilson et al., 1999). Parts could be accessed worldwide to minimize emergency downtime. In order to improve its "on-time in '99" record, the company was going to a system where it held a certain number of parts centrally, a smaller number regionally in its three major markets, and an even smaller number in local stocks. This practice was meant not only to lower inventory-carrying costs, but to improve the service frequency.

Table 2
Incremental changes in service provision as a consequence of technology introduction

Item	Change	Consequence
Communications	Establishment of 24/7 call center	Timely response to emergency calls and repairs on a global basis
	Encouragement of calls directly to field experts	Real-time capabilities. Service personnel on site have help on site.
	Miscellaneous picture-oriented spare parts catalog homepage master	Overcoming of some language problems and moving toward "click away" ordering
Spare parts inventory	ABC treatment of items	Cost savings in inventory carrying charges—frees up capital

7. Incremental changes in organization

As technology changed service, it also had changed the firm's organization. The focus on after-sales, which manifested itself by the appointment of an individual at the business manager level has already been mentioned. This move elevated the service area at least one level in the organization. This move was strategic. Results had already been obtained on the significance of service in operations, and now a person was needed at the proper level to see that attention was paid to operations. Technology played a role in the move—the desirability of having a person in this position became known when the management information system showed not only where sales were coming from, but profit also—a technology development (see Table 3). In other words, as long as it appeared as if profits were accruing from product or regional sales, emphasis was placed there. When it became evident that a significant share of profits and value-creation in the distribution chain were coming from after-sales, then the organization changed to take better advantage of this opportunity.

There were also some subtle changes taking place in the extended organization. This organization has been given the label of a "network," (Anell & Wilson, 2001)

Table 3
Incremental changes in organization as a consequence of technology introduction

Item	Change	Consequence
Responsibility	Management system provides opportunity to evaluate ASS financial contributions	Individual specifically responsible for ASS at corporate level
"Networking" the organization	Devolvement of business plans to distributor level	Focus on ASS as value generator throughout distribution network, e.g., establishes common goals in the network
Communications	Encouragement of calls directly to field experts	Flattens organization-movement toward an ASS network organization

as has become fashionable of late. In other words, as the company itself became more focused on after-sales as a value generator, it became more involved in assisting its distributors in developing similar business plans. Likewise, as it saw the benefits of improving response times, it saw benefits in encouraging intra-company calls among experts to handle service situations—as contrasted to using a centralized coordinator. The net impact was to move the company toward a special "network" organization—one with common goals and a rather flat structure (Table 3).

8. Recognizing IT as an actor

The integration of IT into the after-sales system made it possible to introduce further improvements in its service network. For one thing, the firm created a database that made it possible for subsidiaries to coordinate spare part logistics. The database provided essential information about the availability of certain spare parts and their location, thereby making it possible for interactions among subsidiaries without going through corporate central. Likewise, field service personnel were encouraged to submit service case reports to a centralized database. The idea was that eventually that on-site personnel could use this database as a resource for unusual, or first-time, repairs. This assistance was likely to be more important as the product itself became more complex.

Table 4
Recognizing IT as an actor

Item	Change	Consequence
"Networking" the organization	Subsidiaries, etc. permitted to list slow moving spare parts on intranet site	Corporate production no longer required to produce and hold certain replacement items. Site becomes clearing house for items
Database construction	Encouragement of field service personnel to submit case reports	Service personnel on site have help on site. Data become "memory" for first time, or unusual, repairs
GSM adoption	Device becomes location sensor for equipment. In addition, signals central office if critical component experiences failure	Company has ongoing record of equipment location. Device signals home base when inspection is required

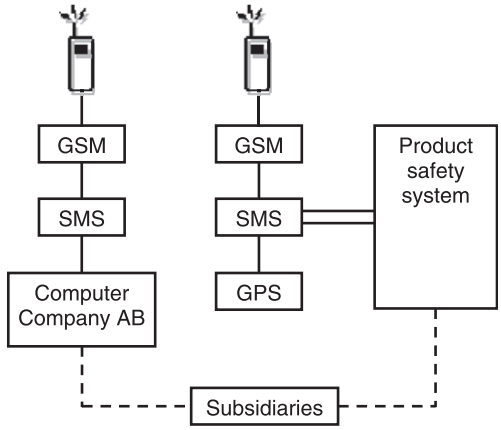


Fig. 2. GSM–SMS–GPS application.

Finally, the firm was on its way to inscribing the product itself to internetworking over a worldwide expanse. This advancement would be the most dramatic improvement made to date. For one thing, the firm had a problem with "rental" equipment—items rented by a firm and transported to different construction sites as required. Because the product is mobile, it is hard to keep track of the products for inspection, maintenance, and/or safety components replacement. The firm suggested that a significant number of outstanding products were being used in unknown locations. By installing a system in each new product that has the ability to self-diagnose, determine its position (GPS—Global Positioning System), create a message (SMS—Short Message Service), and communicate (GSM—Global System for Mobiles) with the firm's system, it would be possible to both keep track of the products and make sure they work properly. In this system, the data will be transferred to the appropriate subsidiary for local action (See Table 4 and Fig. 2).

9. Discussion

Technological or social deterministic perspectives have tended to dominate theorizing of technology in organizations. That is, technology is seen as affecting either work procedures or interactions among workers. These two perspectives cloud the view of technology as an integrated and

participating actor in a general context, especially that of organizing. Any theorizing about after-sales service, or interaction within or between companies, would benefit from incorporating the importance of acknowledging technology as an actor.

The case presented here is one in which a good company has become better by making its after-sales services more responsive by incorporating IT into their delivery. At the same time, it has become more competitive and more cost effective. This process started simply enough by using a faster means of communication. The net effect, however, has been that both the nature of after-sales service itself has changed, and technology has been incorporated into the network as an actor. Consequently, both the traditional observations of technology and associated enhanced profitability have been noted (Hunt, 2000), as well as the technology and organizational changes that have manifested themselves in terms of alternate theories (Latour, 1987; Orlikowski, 1992).

In order to get a more general benefit from the specific case study, it is useful to review results in terms of the models that have been cited. The structuration model of technology (Fig. 1) consists of three components: human agents, technology, and institutional properties of organizations (in this case; Orlikowski, 1992). Her model suggested that the development of technology might start a process. This process can be understood from observations made in the after-sales provision of the case firm. That is,

(a) *technology is a product of human action*

In this case, the technological artifact was IT, which included the hardware and software that manifest itself as internetworking. This technology, of course, was developed external to the firm as is frequently the case. The appropriation by agents, in this instance the after-sales team, created an understanding of the technology.

(b) *Technology is at the same time a medium for human action*

Orlikowski indicated technology used by workers mediates their actions both in a restrictive and enabling manner. It is usually the ''enabling'' aspects that are more interesting to management. For instance, in this study, a 24/7 program was quickly developed. Further, direct interactions between distributors evolved. These interactions included not only service improvisation, but inventory management as well. Restrictions here occurred both with regard to uniformity of technology, the system will not work unless all components in it are compatible, and actions, the sharing of case information.

(c) *Human action is restricted by the institutional properties of the organization*

In other words, the use of any technology (besides what is inscribed into it when produced) draws on the norms, knowledge, and resources in the existing organization. The firm in this case decided to develop a rather open system for its distributors. That is, the evolution of the direct interaction was encouraged, not only by suggestions that intra-company calls be made, but by the development of facilitating elements such as the interactive web for inventory exchange. Implicitly, of course, full benefit accrued to individuals in the network only if they had technology compatible with the firm's. The one explicit restriction that the company maintained was that service representatives receive initial training at corporate offices.

(d) *Human action, when using technology, influences the institutional structures of the organization either by reconstructing or changing it*

There were two levels of changes that might be addressed in this situation. First, the parent organization changed itself. A director of after-sales was named, and after-sales service was made a strategic priority of the firm. This was a first-order, central change. The other change that occurred was the change in the network that distributed products and services for the firm. It became an even more decentralized web with regard to service. It is not quite clear where this evolution/devolution is going to end because it is still a process in progress. It is not unlikely, however, that some of the nodes in the ''web of capabilities'' end up being centers of expertise themselves.

A structuration model thus goes a long way toward rationalizing developments in the case. It should be apparent, however, that conceptualization is not complete with regard to some important details. In the case presented, for instance, the desire for more efficient service on the part of the company necessitated investment in technology to achieve the goal of greater responsiveness and lower cost. The reader may therefore be inclined to ask him/herself, why in Fig. 1 is there not a two-way relationship between Institutional Properties and Technology? This observation, along with a similar question that could be raised with regard to the singular relationship between institutional properties and human agents, really suggests a need for a more general interpretation of technology's role in operations—essentially a lead-in to an ANT interpretation of observations.

To appreciate ANT, it is necessary to understand the concept of an actor of Akrich (1992), Akrich and Latour (1992), and Callon (1991). The immediate tendency is to think of the technology in this case as a tool used by human actors. That is, a reader's bias or expectation would be to have a Turing test for technology—the inability to detect a difference between a machine and a person.[4] In this regard, a citation was made directly from Latour's, 1999 article—that of a gun and a person (we hope that the use of this example does not affect appreciation of the concept; we recognize that gun ownership and use may be a flashpoint among US readership). Latour argues that the goal of each actor has been translated into a third goal—one commensurate with both the individual involved and the technology in use. It is thus a subtle use of the term actor that Latour develops—the

[4] See, for instance, http://cogsci.ucsd.edu/~asaygin//tt/ttesst.html#onlineref for a number of articles reflecting on Alan Turing's suggested test for machine thinking.

ability to affect outcomes. The responsibility for actions is therefore shared between actors, human and nonhuman.

With this background, fuller understanding of the after-sales situation that was reported utilizes Latour's precept—all actors have the potential of initiating action, and all are co-creators of meaning in the actor network. In this instance, the availability of computing power enabled the company to develop an appreciation of the importance of after-sales in its operations. This understanding set in motion a sequence of activities that both changed the organization and its capabilities. The other example that might be cited relates to the evolving situation that will have installations signal location and perhaps repair needs themselves through a GSM–SMS–GPS system.[5] In this system, there will be a certain amount of automation that will provide analytical detection of remedial needs and also provide coverage for one of the firm's ongoing problems—contribution to knowledge of unit locations. This remedy has the potential of increasing after-sale business by a significant amount, i.e., by the fraction of units that tend to get "lost" through normal operations.

What does the paper have to say about management? Consider the suggestions of Calás and Smircich (1999).

(1) The actor and the network are not just things out there to be seen or appreciated by the researcher. Rather, actor network is in itself the conceptual framework—a way of understanding social and technological processes.

It is not the "man in the field" or "the error reporting machine" that produces good service, but the networked organization. In traveling, one knows that it is not the pilot that flies the plane that is responsible for on-time arrival, but SAS, or more correctly the SAS system. Likewise, it follows that the networked organization is responsible for providing the service that distinguishes the firm through what Narus and Anderson (1996) call "webs of capabilities." Put another way, networks need to be considered in their totality in terms of the performance they produce. Further, networks tend not to be the end result of some brave managerial action, or organization chart. Rather, they tend to be organic, with connections between actors growing weaker or stronger as the situation commands. In other words, networks are dynamic, never static. It might help managers as they go through their analyses to think about what actors (human and nonhuman) are needed in terms of capabilities to achieve a satisfactory after-sales service. This process would be a starting point—opportunities, capabilities, and leadership would determine growth.

(2) Thinking in networks requires conceiving of relationships among things in particular ways.

In this case, technology created new opportunities for after-sales service. The argument here is not that this company has developed some new form of organization, but rather, it has experienced a gradual incorporation of IT into its organizing. The concept of internetworking (Orlikowski, 1999) points to the essential understanding that IT is becoming more and more integrated into a company's daily routine, and it is in the process of organizing that any technology being used is adopted and changed. Essentially, technology is being acknowledged as an actor—it has the ability to affect actions. Consequently, the possibilities of new ways to use technology and its role in performance have been enlarged. ANT suggests this extended use of technology is created when it is recognized as an actor in the organization, just as a human actor is. New perspectives create new possibilities.

The consequence has been described as a network of actors. Operations require effective relationships between all actors, human and nonhuman—not only the relationship between the service person and the unit, but also the SMS and GPS in the automated system. Two items are thus important for effective operations of this organization—the presence of capabilities and efficient communication among them. Internetworking has provided this capability.

The question might be asked, why is this topic, this paper, important?

First, since technology is an actor in any organization or context, it should truly be incorporated into the organization and treated as important. Technology is always an actor; the consideration is whether one realizes its inherent possibilities, or relies upon competitors to be shown the way. In a classic sense, the function of an organization is to better utilize the elements of input to effectively obtain output (see, for instance, Jones, 1999). This understanding suggests that the organization schema needs to be deliberate.

This consideration is not trivial. As a simple example, although quite good at the time of the previous interviews, the after-sales effort in this company has now become better since an individual at the top management level has been given this function as his sole responsibility. After-sales service previously provided the company with a comparative advantage; it now has become of special importance to the company and its network of distributors with regard to profitability and value creation. The recognition that technology was important has helped to achieve interim objectives. Likewise, the technology affecting after-sales undoubtedly will make the greatest contribution to profitability and value creation as it continues to be placed strategically in the organization. In the case reported here, and perhaps in general, organizational processes seemed more important than organization structure.

Secondly, technology can be rather seductive. Developments, especially external to the firm, kind of happen and if one is not aware of their happening, they are easy to overlook. In other words, unless someone is looking for ways to make improvements, the opportunity to utilize technology can be missed. It is important to recognize, however, that technology per se can never fulfill inten-

[5] This example may be closer to expectations of having equipment "act" by sending signals. Nevertheless, Latour's definition of presence and possibilities remains consistent throughout.

tions; only the use of technology can. Indeed, because change may be disruptive, incorporation may be resisted. Although this company was incorporating technology into its products, as good as it was, the same initiative was not used in incorporating technology into its after-sales. None of the technology reported here was new; rather, it represented the adoption and innovation with existing knowledge. In each case, changes could have been incorporated into after-sales operations several years sooner. It takes the right organization, the right attention, the right motivation to make these moves, and managers can and/or should be aware of this opportunity in functions such as after-sales where opportunities to internetwork can be overlooked.

Third, there is a tendency to look upon technology as hardware, but even within a narrow sense, technology reflects capabilities. In after-sales service, it has a presence in the product, the equipment used to service the product, and in the ability to communicate among parties the relative health of the product. The organization in this case has become more effective. A significant portion of the company's present benefit has come from the adoption of present technology to utilize people more effectively—the ability to make intra-organizational calls to experts and the incorporation of experience into a database to name but two. Market-directed companies go out of their way to see that their organizations support their distributors and their users—seemingly the essence of the marketing concept.

On the other hand, things have changed. Profitability has not come only from productivity improvement (Bergquist & Ljungberg, 2000), but by improvement of the competitive situation—the improvement of both original equipment sales opportunities and the enhancement of after-sales follow on. It is thus a "second-level" effect. Internetworking (Orlikowski, 1999) is a wide concept, and a web presence is a part of internetworking. Through the online catalog, the firm could supply real-time updates on changes as well as provide distributors a market for replacement equipment. By recognizing the potential of technology, however, the company created new possibilities for after-sales service in the definitive location of equipment and assessing needs for inspection with their GSM–SMS–GPS system. In this situation, technology has become a dominant factor. That is, it serves the same function that an inspector on site might serve. By recognizing the technology as an actor, capable of initiating action, the firm has created an active, self-diagnostic product.

It is worthwhile considering the type of decision processes involved in these situations. In many cases, an initial objective can only be specified qualitatively, e.g., an improvement in efficiency or quality—in this case, to be best on site. Subsequent activities will produce feedback from results to indicate what can be achieved. These processes of course can be associated with Lindblom's (1959) classic "muddling through" treatise. Although the original article was written to account for certain aspects of administrative decision-making, these processes apply equally well to certain "projects" undertaken by service organizations. The feedback will indicate not only what might be done, it will tend to give direction—the function of technology as an actor.

Fourth, the conceptualization of the capital goods (heavy equipment) business seems to be changing toward recognizing the importance of after-sales service with regard to meeting expectations (Levitt, 1983; Wilson et al., 1999), providing profitability (Herbig & Palumbo, 1993), establishing customer loyalty (Smith, 1998), and differentiating firms from competitors (Narus & Anderson, 1996; Porter, 1980). This case suggests the potential for establishing contact with final users through the equipment itself and the importance that influential intermediaries (the service personnel) have on this business.

Finally, organizations themselves are changing. Technology is important not only in communication but in capabilities as well and, in effect, tend to drive these changes. "Webs of capabilities" (Narus & Anderson, 1996) have become quite literal. Flexibility tends to be a characteristic of these organizations, and processes may be more important than structure.

10. Conclusions

A case study has been utilized to show how technology incorporation has both improved service delivery and changed an organization. The case was not one of a turnaround, but rather a good, perhaps model, company getting better. The changes were both rapid and far-reaching in detail. They started with a simple change in a communication medium and progressed to the technology being recognized as an actor in the organization. Rather remarkably, changes appear to have developed with a minimum of disruption, which may be a consequence in part of the technology itself favoring subsequent changes. Consequently, perhaps one outcome of this study will be to encourage leaders/managers to utilize some of the precepts of ANT in their thinking.

Acknowledgements

This research was funded in part by the European Union's Regional Development Fund. The ongoing support of Umeå University and the cooperation of the firm in this study are also acknowledged.

References

Aaker, D. A., & Day, G. S. (1990). *Marketing research* (4th ed.). New York: Wiley, p. 174.

Akrich, M. (1992). The description of technical objects. In W. E. Bijker, & J. Law (Eds.), *Shaping technology/building society* (pp. 205–224). Boston: MIT Press.

Akrich, M., & Latour, B. (1992). A summary of a convenient vocabulary for the semiotics of human and nonhuman assemblies. In W. E. Bijker, & J. Law (Eds.), *Shaping technology/building society* (pp. 259–264). Boston: MIT Press.

Anell, B. I., & Wilson, T. L. (2001). Channel structures of international after-sales networks. *Journal of Marketing Channels*, *9*(1–2), 93–124.

Bergquist, M., & Ljungberg, J. (2000). Communication—from management to organizing. In K. Braa, C. Sørensen, & B. Dahlbom (Eds.), *Planet internet* (pp. 65–85). Lund, Sweden: Studentlitteratur.

Bonoma, T. V. (1985). Case research in marketing: Opportunities, problems, and a process. *Journal of Marketing Research*, *22*(2), 199–208.

Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications of the ACM*, *36*(12), 67–77.

Calás, M. B., & Smircich, L. (1999). Past postmodernism? Reflections and tentative directions. *Academy of Management Review*, *24*(4), 649–671.

Callon, M. (1991). Techno-economic networks and irreversibility. In J. Law (Ed.), *A sociology of monsters: Essays on power, technology and domination* (pp. 132–161). London: Routledge.

Callon, M. (1994). Is science a public good? *Science, Technology and Human Values*, *19*(4), 395–424.

Carter, N. M. (1984). Computerization as a predominate technology: Its influence on the structure of newspaper organizations. *Academy of Management Journal*, *27*(2), 247–270.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology*, *6*, 1–22.

Company AB (2001). *Annual report for the financial year 2000* (in English).

Davis, L. E. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.

Davis, L. E., & Taylor, J. C. (1986). Technology, organization and job structure. In R. Dubin (Ed.), *Handbook of work, organization, and society* (pp. 379–419). Chicago: Rand McNally.

Foster, L. W., & Flynn, D. M. (1984). Management information technology: Its effects on organizational form and function. *MIS Quarterly*, 229–235.

Giddens, A. (1984). *The constitution of society—outline of the theory of structuration*. Cambridge, UK: Polity Press.

Green, P. E., Tull, D. S., & Albaum, G. (1988). *Research for marketing decisions* (5th ed.). London: Prentice-Hall, pp. 102–102.

Grönroos, C. (1983). Innovative marketing strategies and organization structures for service firms. In L. L. Berry, L. G. Shostack, & G. D. Upah (Eds.), *Emerging perspectives on services marketing* (pp. 9–21). Chicago, IL: American Marketing Association.

Haas, R. W. (1995). *Business marketing: a managerial approach* (6th ed.). Cincinnati, OH: South-Western Publishing.

Herbig, P. A., & Palumbo, F. (1993). Serving the aftermarket in Japan and the United States. *Industrial Marketing Management*, *22*, 339–346.

Hiltz, S. R., & Johnson, K. (1990). User satisfaction with computer-mediated communication systems. *Management Science*, *36*(3), 101–102.

Hunt, S. D. (2000). *A general theory of economic growth: Resources, competences, productivity, economic growth*. Thousand Oaks, CA: Sage Publications.

Jones, G. R. (1999). *Organizational theory: Text and cases* (2nd ed.). Reading, MA: Addison-Wesley.

Kling, R., & Iacono, S. C. (1984). Computing as an occasion for social control. *Journal of Social Issues*, *40*, 77–96.

Latour, B. (1987). *Science in action*. London: Open Univ. Press.

Latour, B. (1992). Where are the missing masses? The sociology of a few mundane artifacts. In W. E. Bijker, & J. Law (Eds.), *Shaping technology/building society* (pp. 225–258). Boston: MIT Press.

Latour, B. (1999). *Pandora's hope: Essays on the reality of science studies*. Cambridge, MA: Harvard Univ. Press.

Leavitt, H. J., & Whistler, T. L. (1958). Management in the 1980s. *Harvard Business Review*, *36*(6), 41–48.

Levitt, T. (1983). After the sale is over. *Harvard Business Review*, *71*(5), 87–93.

Lindblom, C. E. (1959). The science of muddling through. *Public Administrative Review*, *19*, 79–88.

Markus, M. L. (1983). Power, politics, and MIS implementation. *Communications of the ACM*, *26*, 430–444.

Narus, J. A., & Anderson, J. C. (1996). Rethinking distribution: Adaptive channels. *Harvard Business Review*, *74*(4), 112–120.

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organizational Science*, *3*(3), 398–427.

Orlikowski, W. J. (1999). The truth is not out there: An enacted view of the "digital economy". *Understanding the digital economy: Data, tools, and research*. Washington, DC: Department of Commerce. http://mitpress.mit.edu/books/0262523302/ude.html.

Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, *11*(4), 404–428.

Perrow, C. (1983). The organizational context of human factors engineering. *Administration Science Quarterly*, *28*, 521–541.

Pfeffer, J., & Leblebici, H. (1977). Information technology in organizational structure. *Pacific Sociological Review*, *20*, 241–261.

Porter, M. E. (1980). *Competitive strategy*. New York: Free Press.

Siegel, J., Dubrovsky, V., Kierler, S., & McGuire, T. W. (1986). Group processes in computer-mediated communication. *Organizational Behavior and Human Decision Processes*, *37*, 157–187.

Smith, K. (1998). Service aspects of industrial products lead to future product purchase intentions. *Industrial Marketing Management*, *27*, 83–93.

Trist, E. L., Higgins, W., Murray, H., & Pollock, A. B. (1963). *Organizational choice*. London: Tavistock.

Wilson, T. L. (1999). International after-sales services. *Journal of Global Marketing*, *13*(1), 5–27.

Wilson, T. L., Boström, U., & Lundin, R. (1999). Communications and expectations in after-sales service provision: Experience of an international Swedish firm. *Industrial Marketing Management*, *28*, 381–394.

Yin, R. K. (1994). *Case study research: Design and methods*. Thousand Oaks, CA: Sage Publications.

Zuboff, S. (1988). *The age of the smart machine*. New York: Basic Books.

Peter Zackariasson is a Ph.D. student at the Umeå School of Business and Economics, and this work reflects part of his dissertation interest dealing with leadership and technology.

Timothy L. Wilson is Visiting Professor of Marketing on an extended basis at the Umeå School of Business and Economics.