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Hybrid Agency in Co-Configuration Work

Summary

This article maintains that a new wave in the development of the productive forces of society triggered by the revolution in information and communication technologies is taking place. Production carried out by single organizations is increasingly replaced by forms of production that are based on close long-term collaboration between specialized firms. This transition reflects the increasing importance of research and development as well as collective learning in business competition. New information and communication technologies enable new forms of distributed and collaborative knowledge creation and learning. The article explores an emerging new form of innovation-oriented inter-firm collaboration called co-configuration and the new kind of dualistic agency it seems to be calling for. In this form of collaboration the traditional boundary between producer and provider as well as the boundaries between product development, sales and maintenance within the provider organization become blurred. The article presents a case of the development of co-configuration work in the provision of optimization software for pulp production. The case shows some of the contradictions involved in this new form of collaboration and the development of a new kind of object-oriented collaborative agency mediated through a real-time information and communication technological platform and uniting two processes of continuous development.

The information-technological revolution as a new wave in the socialization of production

The development of the productive forces of society is characterized by their progressive socialization. Elements of the labor process are socialized insofar as they come to embody capabilities developed in the broader society rather than only those that emerge from private experience and the local context. The socialization of the forces of production takes place as the deepening of the social division of labor and the development of increasingly complex relationships of exchange and interdependence between occupations, organizations, industries, and regions (Marx, 1973, 750). This development is not smooth and linear. On the contrary, a growing contradiction arises between the need for the further socialization of production processes and the constraints on that socialization put forth by the dynamics of the processes of valorization connected to it. Out of this contradiction emerges qualitatively distinct types of economic activity and patterns of organizing and managing production (Adler, 2002). These do not only concern the production proper, but also forms of knowledge production, development, and individual and collective learning (Freeman & Louça, 2000). In this historical process of the socialization of production, subjectivities and forms of work-related agency are also transformed.

In the history of industrialization, new types and layers of technology have progressively reclaimed their place as collectively used tools from tools that were individually operated and as shared explicit knowledge from individual tacit knowledge. Now, we seem to be witnessing a qualitatively new wave in the socialization of productive forces, triggered by new information and communication technologies and new conditions of global competition. Three, closely interlinked new developments that characterize this new form of the socialization of productive forces create the background for the subsequent analysis in this article: 1) the rise of research and development into a central element in "production"; 2) the competence-based specialization of firms and the evolution of value creating constellations between these, and 3) the informatization of production and exchange.

Research and development activities have become central in the competition between firms. Not only has the relative amount of research and development increased, but also the cycles of generations of new technologies and products increasingly determine business organization and processes. This development has led firms to specialize in not types of products, but rather in areas of competence in which they can continuously innovate and deepen their know-how (Hamel & Heene, 2000). Functions of production that are not vital to these areas are outsourced. This bifurcation is counterbalanced by the increase in long-term strategic alliances and partnerships as well as new forms of cooperation between firms regulated through relational forms of contracting (Powell et al, 1996; Uzzi, 1997). Specialized firms use their competence in changing constellations of collaboration to master complex objects that comprise the production of both physical products and services as well as the continuous research and development of these (Normann & Ramirez, 1994). These new organizational forms typically blend the three basic methods of governance and control, i.e. hierarchical decision making, market transactions and collaboration based on common interest, complementary resources and mutual trust (Powell, 1990). The informatization of production and exchange, that is, the recording, copying, storing, distributing, and processing of data about the object and process of production made possible by new information and communication technology makes activities transparent to those involved in a new way (Zuboff, 1984). Informatization is not only a new aspect of intra-firm collaboration but also increasingly a vital element in firm-firm and firm-customer exchange and collaboration.

The three lines of development described above coincide in the evolving new forms of production characterized by the continuous collaborative reconfiguration of the combination of products and services that connects the provider (or provider network) and the user. Bart Victor and Andrew Boynton (1998,193-297) have used the term 'co-configuration work' for this form of production. According to them co-configuration work is characterized by the following features:

1) A customer-intelligent product that can be continuously adapted to changing conditions and customer needs.
2) A collaborative value-creation system in which the value is not produced in the provider activity nor in the user activity separately but in the interaction and collaboration between them.
3) Reconfiguring of the product by the client. The customer can 'teach' the product.
4) Continuous customization. The producer does not customize the product only once but continuously and updates it continuously for instance through changes in the

software. The product becomes increasingly well adapted to customer's needs but is never complete.

This type of production is a solution to the growing contradiction between, on the one hand, fixed products, and on the other, rapidly proceeding technological development and changing customer needs. This new kind of nexus between firms meets the customers' expectation of benefiting from their investment for a long time and the provider's need for long-term customer relationships.

The characterization of co-configuration work provided by Victor and Boynton (1989) helps to identify aspects of this evolving new form of production. It focuses attention especially on two basic boundaries that have to be crossed in this kind of long-term collaboration: One between research and development and production and the other between the provider and the user. However, in order to understand this new form of work, we should, instead of trying to make empirical generalizations concerning its typical features, try to capture the kinds of contradictions it seeks to overcome and map the territory of alternative solutions to these contradictions. In order to do this, it is not enough to analyze the solutions that the informatization of production provides. Further, the various new forms of the socialization of production-related learning and the development connected to it have to be analyzed.

Forms and contexts of agency in production-related learning and development in co-configuration work

When speaking of human agency, we attribute the initiation of causal sequences to a person or collective: An agent is one who 'causes events to happen' in their vicinity – although not necessarily just those that the agent intended. Agency implies a certain amount of stubbornness in changing the given conditions, even against the tide. According to Emisbayer and Mishe's (1998) well-known definition "Agency is a temporally embedded process of social engagement, informed by the past, oriented through evaluation of present toward future possibilities." The orientation to future possibilities depends centrally on the actors' beliefs about their capabilities of exercising control over what is going on (Bandura, 1989, 1175-1177). Exercising control implies a relationship to an object of activity and to other human beings. Thus a realistic belief in one's capacity to exercise control over a process depends on the actor's access to and command of adequate conceptual and practical tools as well as the prevailing social norms and social relationships of collaboration in the community.

In science and technology, there is a tension between two contexts of agency in learning and development: The Mertonian 'scientific communism' of research results and secret corporate research and development. A similar tension can be seen in the practical development of new technologies. On the one hand, there is the systematic, bureaucratically organized product development that takes place in utmost secrecy within a firm as an internal function (Clark &Wheelwright, 1995). On the other hand, there are episodes and areas of what Nuovolari (2001) has called *'collective invention'*. Nuovolari's example is the development of the steam engine used in coalmines to run water pumps. After the expiration of Watt's patent on the steam engine in 1800, the engineers of the mines in the Cornwall area established a journal through which they exchanged drawings of improvements in the machine's construction as well as results of their experiments with new solutions in the design of the steam engine. Through this process of collective invention, the capacity of the engines increased remarkably without specific research and development investment.

Mayer (2003) has reported several periods of similar collective invention in the history of industry, the newest one, of course, being open-source software development (Moon & Sproull, 2002). In these cases the socialization of learning and development takes place because the same technology is used in disparate, analogous but otherwise quite unrelated activities and thus problems and solutions related to the use of the technology become common (Rosenberg, 1963). Some firms have also developed ways of taking advantage of their customers' collective innovation processes in their internal product development (Jeppesen, 2001).

In Victor and Boynton's (1998) model of co-configuration work, the emphasis is on the vertical one-to-one relationship between the provider (who is supposed to have an internal research and development function) and a client. The pattern of collective invention, on the other hand, is based on a horizontal exchange of ideas between user-developers. Besides the vertical and horizontal lines of the socialization of learning and development, there is, however, a third, important dimension that can be characterized as *systemic*. This dimension is about collaboration between specialists in more complex constellations in order to master broader and more complex problems and objects of activity (Engeström, 1992). We can assume that these three forms of the socialization of learning and development call for and enable different forms of agency in learning and development.

In sociology and anthropology the context of individual and group agency has been conceptualized in terms of 'social segments', 'communities of practice' or 'social worlds' (Bucher & Strauss, 1961; Lave & Wenger, 1991; Strauss, 1978). These conceptualizations marginalize the role of technological artifacts, instruments, and forms of representation as well as bureaucratic structures in enabling agency. According to Keating and Cambrosio (2003, 19), studies of the organization of craft and industrial activities have tended to define the division of labor as a division of laborers, furthermore assuming that the latter always precedes the division of the object upon which people work. The highlighting of the social division in this way emerged partly as a reaction against attempts to "naturalize" the division of labor by assuming a predetermined division of the world into objects around which occupations would establish themselves. Both approaches are, however, problematic when one has to explain agency in the context of the mastery of complex objects and change processes. The challenge is to describe how a complex object of activity as well as the division of labor and forms of collaboration can be constructed and represented at the same time through specific mediating artifacts.

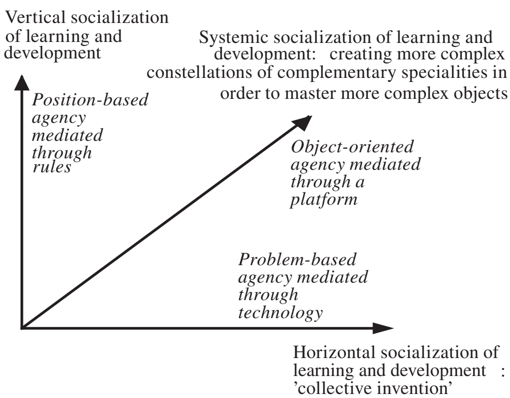
Keating and Cambrosio (2003) have developed the concept of a *biomedical platform* to explain how, despite the increasing specialization of medical activities and the fragmentation of the patient when taking samples and making analyses, the overall picture can be retained. According to them, this integration is achieved through a twin practice of sampling and modeling that corresponds to a sequential pattern of representation and intervention. Samples and test results are about somebody, a patient (the empirical object J.V.), but at the same time they are about some thing, a model of the body and it's various 'systems' (a theoretically conceptualized object, J.V.). Samples and test results, on one hand, and the representation of the patient's condition, on the other, both presuppose and give rise to patterns of cooperation that cannot be dissociated from the tools used to produce the representations of body parts and ultimately to intervene in the patient's body. In this collaboration, individual tools acquire consistency and meaning only through the regulatory activities generated by a given platform. According to Keating and Cambrosio (2003, 21) human collectives would fall apart without platforms and the pattern of activities they generate. On the other hand, platforms do not determine the actors' position; actors situate themselves vis-à-vis a platform. A platform defines a domain of action, within which a variety of stances and attitudes that range from controversy to peaceful coexistence and cooperation can emerge.[1]

A platform structure, as Cambrosio and Keating describe it, is a complex instrumentality that mediates the interaction between theoretical understanding and practical intervention as well as the interaction between forms of specialized knowledge. According to Knorr-Cetina and Brugger (2001), a platform is a forum for exteriorizing production-related processes and activities. It represents a sort of distributed cognition, or collective consciousness, about the state of affairs that is relevant to the production and its development. It makes the exteriorized actions and observations available for reaction, re-entry, reproduction and change. In this way it also binds individuals' actions to the collective activity in a new, more transparent way. Because of these new kinds of instrumentalities, dispersed organizational forms may remain dispersed and network-like in terms of the geographical location of formal organizational components but may at the same time act in concert when it comes to the mastery of a complex object.

According to Knorr-Cetina and Brugger (2001; see also Ciborra, 1996), a platform organization constitutes a new type of organization that differs from both bureaucratic and network-based organizational forms in that forms of coordination based on social authority become to a great extent replaced by content-based coordination that becomes possible because the platform informs all participants, in real time, about the state of the object of the activity and the ongoing organizational processes as well as about actions taken by other organizational actors. The actors' real-time orientation to the overall situation of the activity process makes, according to Knorr-Cetina and Brugger, *voluntarism* possible based on an observation of the need for action to contribute to or to direct the ongoing process of joint activity. This form of voluntarism reflects a kind of *object-oriented, content-based agency* that differs from the forms of position-based agency typical of traditional bureaucratic organizations (Kallinikos, 2003). It differs also from the technology and problem-oriented agency typical of collective invention, in which the exchange of individuals' solutions to problems in the use of the same technology accrues into its continuous improvement. The three dimensions of the socialization of learning and development and the corresponding ideal-typical forms of agency have been depicted in Figure 1.

Each form of work activity requires specific

Figure 1. Dimensions of the socialization of learning and development and forms of developmental agency



1 Keating and Cambrosio (2003) do not want to offer a generic theoretical concept of platform but to discuss biomedical platforms specifically. Their reservation is important and suggests, that although the biomedical platform can be used as a heuristic example, the functions and structures of platforms in other areas have to be studied in their specific historical and present day context and in relation to the specific object of the collaborative activity they enable.

types of instruments and ways of representing the object of the activity. The concept of platform seems to capture some important features of the kind of instrumentality that makes co-configuration work possible, in which two or more relatively independent activities act upon a partly shared object. This kind of instrumentality resembles what Hans-Jörg Rheinberger (1997, 135-136) has described as the fusion of experimental systems in scientific research in how originally unconnected experimental systems and fields of research become connected so that eventually new theories that connect fields of research emerge. In a similar vein hybridization of tools and representations of two previously independent activities can lead to a new way of representing and mastering a complex object. In co-configuration work design and use merge and the corresponding social roles become hybrid so that designers are involved in use and vice-versa (Callon, 2004). This hybridization creates communities consisting of actors with different competencies and sometimes antagonistic interests and conceptions whose agency and collaboration is made possible by the specific instrumentality.

Following Rheinberger's (1997, 136) idea, I suggest a concept of hybrid (or double) agency based on an amalgamation of different activity systems that retain their specific objects and logic and their specific ways of reproduction, although the objects of these activities overlap. Hybrid agency thus implies a double object of activity for one actor and partially – but only partially – overlapping objects of several activity systems. An individual's or group's agency has this character of hybridity when the individual or group evaluates the present from two perspectives at the same time and orients to interrelated future developments in two activity systems. Hybrid agency thus presupposes as its context a long-term collaboration between two activity systems that preserve their identity in the collaboration and a platform that bridges the divergent activities and supports their coordination. In relation to the production that is being developed we could also speak about object-oriented interagency (see Engeström, 2004). This form of agency differs qualitatively from the various kinds of combined agents that are formed in organizations by collecting specialists into task forces, projects or cross-functional and multi-professional teams to deal with a transitory problem or task.

The evolution of aspects of co-configuration production and hybrid agency in a high-tech business-to-business activity

Valmet Automation (later Metso Automation) is an internationally operating provider of automation systems for process industries. In 1988, it started to develop new high-level automation solutions that optimize specific phases of pulp production. This new type of product led to qualitative changes in the firm's collaboration with its customers and the crossing of traditional organizational boundaries within the firm. Many of the new features can be seen as elements of co-configuration production. In the following, I analyze the historical development of these features in the evolution of this high-tech business.

The data for the analysis has been collected in connection with a developmental intervention in which the author as an external researcher-interventionist helped a group of product developers, producers and maintenance persons to analyze the history of and current contradictions in their activity system and to plan a model for its future. The data consists of interviews with the internal specialists in the firm involved in this business and some key clients, ethnographic data about the implementation and maintenance of optimization software, and videotapes and transcripts of the 12 two-hour intervention sessions.

I will first shortly describe pulp production to give the context of the object of the activity. Then, I will describe the essential characteristics of the provision of basic automation, which was the method of operation of Valmet Automation before the new developments. Next, I will describe the main phases of the transformation of the activity and the specific contradictions and problems connected to them as well as the solutions created. Finally I will discuss the concepts of hybrid agency and co-configuration production in view of this case.

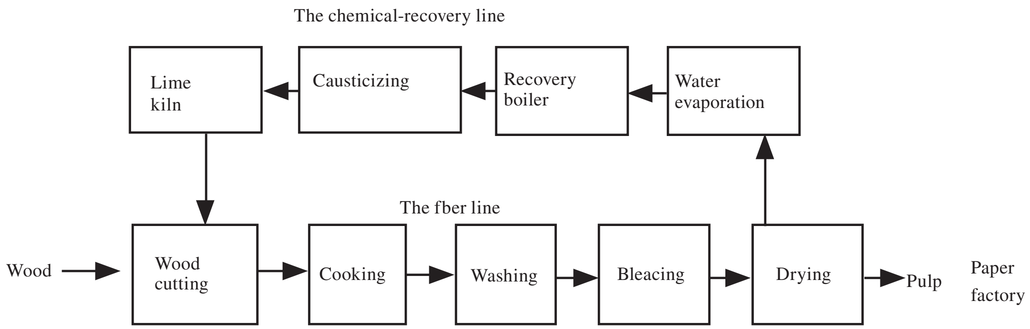
Pulp production and its automation

Wood fiber pulp is an important raw material in paper production. In pulp production, the fibers of wood are mechanically and chemically separated from lingnin and other components that lower the quality of the paper. A *pulp mill* typically consists of two process lines and a power plant that uses the byproducts of the pulp production to produce energy for the mill. *The fiber line* starts from the mechanical handling and cutting of the wood. The wood chips and, later, fibers then go through the phases of cooking, washing, bleaching, and drying. The chemicals used in the fiber line are processed for reuse in the *chemical recovery line*, which consists of a water evaporation plant, a recovery boiler, a causticizing plant, and a lime kiln. Figure 2 depicts schematically the two lines of a pulp mill.

The automation of the pulp process can be divided into two main levels. *Basic automation* consists of, on the one hand, measurement and control devices that regulate the feeding of materials, the temperature level and other parameters of the processes in the various phases of production, and, on the other, the sequence automation that controls the conveyance of the processed raw material from phase to phase. *Process optimization automation* regulates the settings of the basic automation to optimize the use of materials and energy as well as the quality of the output. Optimization automation consists of optimization software systems for each phase of the two lines of production. There can also be a software system that coordinates the activity of the phase-optimization systems of a line. Because of the great amounts of materials used in the process, optimization software can generate remarkable savings in raw material and chemicals as well as stabilize the end product quality. Some problems in the physical production machinery can also be compensated for with effective optimization software to avoid expensive machine investments.

Pulp mills typically produce different types of pulp and use different types of wood as raw material. For each combination of raw material and product quality there is a different recipe

Figure 2. The two lines and the typical phases of production in a pulp mill



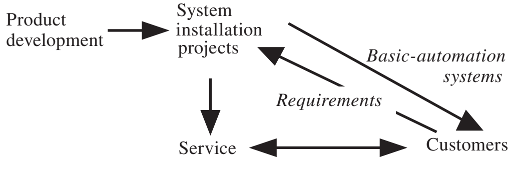
and way of running the plant. Therefore there also has to be specific optimization software for each recipe. Pulp mills are typically located near paper factories and often sell part of their production directly to one factory and part to the open market. Recently there has been a tendency towards a tightening collaboration between pulp and paper factories in paper product development.

An optimization automation system has an analogous platform structure to the one Keating and Cambrosio have identified in biomedicine. The measuring instruments produce data about the actual production process that is connected to an integrated model of the key relationships between important process parameters. On the basis of the measurement data, the software builds a real-time 'diagnostic picture' of the progress of the production process and intervenes in it through changes in the settings of the lower level automation to keep the process parameters at the optimum. This automation platform is partly transparent and partly opaque. Both the operators of the pulp factory and the specialists of the provider organization can follow on screen the changes in the process parameters and the settings. The 'reasoning' of the optimization software, that is, the logic of its calculations in moving from measurement inputs to outputs in resetting the basic automation, remains, however, largely opaque to the operators. The opaqueness of the 'reasoning' of the machine creates a specific problem for them. The time lag between a resetting of the basic automation to changes in the values of key process parameters of the actual process can be many hours. When an operator sees a trend in the wrong direction in the process he has to trust that the optimization software system has recognized the same trend and made the right counter readjustments in the basic automation. If the operator does not trust the system, he has a strong motive to bypass it and intervene directly in the process to prevent a disastrous development.

The sequential logic of providing systems of basic automation

When a factory in a process industry orders a basic automation system or piece of equipment, the key person on the client side is typically the automation engineer of the factory who specifies exactly what functions, capacity and other requirements the provided equipment has to meet. The provider produces the equipment, installs it, and leaves the factory when the equipment has fulfilled the requirements set by the customer. An automation system is built from standard elements that can thus be installed with little customization. A basic automation system or piece of equipment can be designed and installed on the basis of general knowledge concerning automation and control technology without a deep understanding of the chemical and physical processes of the specific production process in which the technology is implemented, because the customer translates that knowledge into the language of automation-system design when specifying the requirements set for the system. Automation equipment is subject to normal wear and breakage that calls for regular service and periodic replacements. After the system or equipment has been installed, its maintenance is therefore typically handed over to a separate service organization. The provision of basic automation systems corresponds thus to the traditional linear sequence from product development to installation and then to service (Figure 3).

Figure 3. The linear sequence from product development to installation project and service in the provision of basic automation systems



The development of process-optimization automation

In 1988, Valmet Automation started to develop the first optimization software system for pulp production. A developer of optimization software has to know the specific chemical and physical processes involved in the phase of production to be optimized very well. This new knowledge was acquired by hiring students from a technical university to do their theses about optimization parameters and models for a specific phase of a pulp production line. The product development of the optimization software system was to a great extent done in close collaboration with a customer's production organization in the customer's pulp mill. In this collaboration the key partner in the client organization was not the automation engineer but the production manager. The relationship with the client was also not mediated through requirement specifications prepared by the client, but through a view of the possibilities for improvement in production with the help of the optimization software.

In the period from 1988 to 1997 Metso Automation hired engineers to develop optimization software systems for the various phases of the two lines in pulp production. These product developers created a new kind of competence that combined a deep understanding of the physical, chemical and technological processes involved in a specific phase of pulp production and process automation know-how. A division of labor and specialization based on phases of pulp production naturally evolved as the same person both developed the product and installed the developed software system in the customers' factories. The former clear division of labor between product development and installation was not possible because each piece of optimization software had to be customized to the specific conditions of the client's factory and also because an important part of the product development took place in connection with this customization work. Because the development of optimization software calls for the understanding of the specific process to be optimized, the automation department created a new industry-based unit structure. A specialized unit for pulp production optimization was formally established in 1995.

At that time the customers were charged for the work done by Metso's specialists on the basis of work hours. For Metso, the first priority then, however, was to get good client references for the new product. The product developers began to involve also engineers from Metso's service organization in the installation projects to delegate some of the maintenance and reconfiguring work to them after the installation of the software. As more software packages were installed in various pulp mills, the amount of maintenance work increased and the developer's work began to change. They no longer only developed and installed optimization software systems but had increasingly also to take care of the reconfiguring of software packages that had been installed earlier.

In traditional automation equipment delivery the provider typically leaves the equipment to the customer when tests of the installed equipment show that the requirements are met. The client pays the price of the system and buys maintenance services that are charged on the basis of man-hours. At first, this arrangement was followed when the optimization software packages were installed. In this case, there were, however, no specifications to determine when the order had been fulfilled. After 1996 maintenance of the software packages began to be a problem. As the clients made changes in their production equipment, raw-materials and recipes, the software no longer functioned properly and the Metso specialists were called to come and tune it up. Sometimes the client did not do this and instead simply turned off the optimization software system. To solve these problems, and to further the sales of the packages, Metso developed a new type of gains-sharing agreement with the customers called (performance) 'development agreement'.

The development agreement changed the previous rules of client cooperation radically. Firstly, although the client was paying a basic price (20%) to have the software package, 80% of the price for the software was tied to the attainment of jointly agreed upon improvement targets in certain parameters of production. If the targets were attained during the period of the agreement, the client would pay the full price, if not, a reduced price would be paid. In the official contract it is agreed that the customer and Metso make changes in consensus to the software to reach the set targets and that the parties do not change the contact persons during the agreement period. In the first performance development agreement it was also agreed that the specialists from Metso would work a certain number of hours in the client's plant. Although the clients found the Metso specialists' visits to their plants to be important, this part of the agreement contradicted the new principle of compensation based on production performance and was not included in the agreements later on. According to the standard contract, Metso could utilize the experience and innovations created in this customer collaboration in its other client relationships, thus enabling horizontal know-how transfer between pulp mills. The agreement was further developed in 2000, when it was agreed for the first time that although the agreement proper covered only 12 months, the intention of the parties was to have continuous collaboration. It was then also agreed that the client and Metso's specialists would have a review meeting two times a year to evaluate the progress and to plan further actions.

During the period from 1995 to 2002 a kind of hybrid agency in relation to a specific client-software combination evolved, consisting of the product developer, unofficially called the 'head godfather' [of the client factory], and the person from the service organization working with him in the implementation and later taking care of the maintenance of the software, called the 'local godfather'. These two representatives of Metso were co-operating regularly with the production management and operators of the client factories. The local godfathers were initially working part-time in addition to the maintenance of basic automation, but in 2002 the first three local godfathers started to work full time. The collaboration of these three parties is supported by Metso's pulp process optimization platform. Through it, each party independently has access to the production-process data of the client's pulp mill and can and does evaluate the state of the production process and constructs future possibilities for its progress and development. However, only the representatives of Metso can make changes in the software – although the client can suggest them – and only the client can change other elements of the process – although the representatives of Metso can suggest such changes.

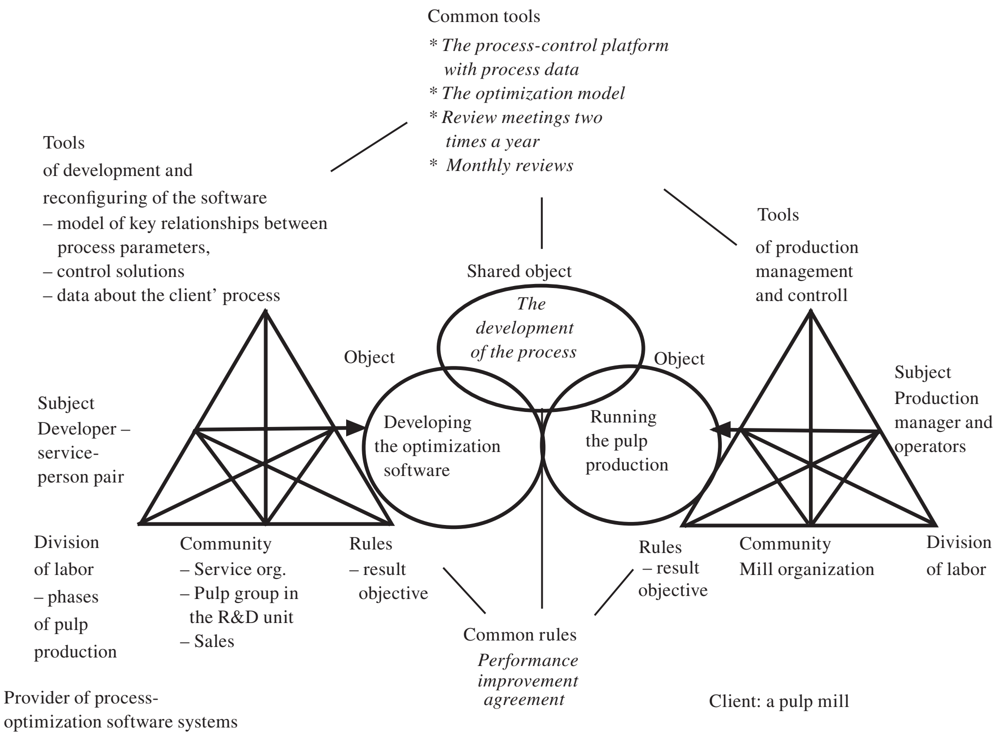
In 2003, optimization software packages had been developed for all the phases of the fiber line and the chemical-recovery line (see Figure 2). The emphasis on product development had turned, on the one hand, from the development of new products to the improvement of the existing ones and, on the other, from specific phases of the process to whole lines. In 2002 and 2003 the number of installed optimization software systems and development agreements increased rapidly, highlighting the need to rationalize the work and to develop tools for it. There was, however, not much capacity to proceed in this work.

During the last ten years, as a result of many separate changes, a new pattern of inter-firm collaboration has emerged that differs to a great extent from the one typical of the provision of basic automation systems and equipment. In the official development agreement the customer "orders and enables the provider to maintain and develop the optimization software the provider has previously installed". In interviews and discussions with the Metso specialists, however, the software is viewed as a tool for them to develop the client's production process. In addition, the representatives of the clients see the development of the production, not the maintenance of the software as such, as the primary object of the collaboration. Because the compensation of the service is based on improvements in production, this interpretation is quite adequate. In this sense the provider and the user of the optimization software system partly share the object of developing the client's production process. On the other hand, they see it from quite different points of views and contexts. The structure of the new platform-based inter-firm collaboration is schematically depicted in Figure 4.

In 2002, the new business activity of installing optimization software and developing the processes with the help of the software was in a phase in which the business management wanted to shift the focus from developing the products to their sale. The role of the specialists who had developed the software packages and who were the carriers of the new know-how had to be re-evaluated as well as the collaboration between the product development and the service organization. The new model was searched for in a developmental intervention called a "boundary crossing laboratory", in which the head godfathers and local godfathers jointly analyzed the developmental phase of the activity and its prospects with the help of an external researcher interventionist (the author of this paper).

Two main problems emerged in the discussions in the intervention sessions, one concerning the division of labor between the

Figure 4. The new form of inter-firm collaboration



developers and the engineers of the service organization, the other concerning the content and principles of the compensation of the service provided for the customer. The product specialists ('head godfathers') felt strongly that they were in a double-bind situation with contradictory expectations and obligations projected upon them concerning, on the one hand, 'production and maintenance', that is, helping to sell the new product, carrying out installation projects in pulp mills, keeping contact with the customers and developing their processes by making changes in the optimization software, and, on the other hand, product development, that is, creating new generations of the software, the platform for co-operation and the tools for installation and maintenance. They were carrying out activities that in the traditional organization were the tasks of a number of specialized units.

Several reasons were found for this contradictory situation. First, much of the know-how was still the personal knowledge of the specialists and they had not had the time and interest to standardize the solutions that were developed and to document the know-how in order to make it easier to delegate some of their work and to rationalize it further. The product development was closely tied to client projects and was actually carried out to an important extent in the plants of the clients that agreed to take the role of a pilot in the development process. The boundaries between configuring, customizing and developing the software were not clear, and no clear point could be defined at which one could declare the product and installation to be completed. Rather, continuous reconfiguring and further development of the product was needed. Because of this, the product developers were needed for the "maintenance" of the software. For the local godfathers of the service organization the main problem was that they were not always involved early enough in projects to acquaint themselves with the customer's process and the customized software they were supposed to maintain and reconfigure later.

Were the optimization software an ordinary, fixed product, these would be typical problems of the transition from the development of the product to its production. The contradictory needs of the implementation of new software systems and the reconfiguring and development of the earlier installed ones, are, in this case however, only partially explainable as problems of transition. Rather, the problems were caused by contradictions in the continuous client collaboration. The different rhythms and locations of the implementation work and the continuous maintenance and reconfiguration of the installed software packages created one of these contradictions. In order to be able to continue the customization and reconfiguring of the software after the initial installation, the local godfather has to take part in the installation work. That, however, takes him for long periods to distant locations and interferes with the continuous collaboration with other customers. However, there seems to be no way of splitting the hybrid agent composed of the head godfather and the local godfather in the traditional way into a developer installer and a maintainer part, even though part of the work can be flexibly divided between those two.

Another contradiction was related to the compensation for service. The idea of gains sharing on the basis of improvement in the performance of the production process rather than the sale of the software as a product and charging for its maintenance on the basis of work hours was at first a clear improvement compared to the old system inherited from the sale of basic automation systems. This form of compensation gave the Metso specialists more room to plan their work. Later on, it has, however, become problematic for two reasons. First, the more difficult the case, the more Metso has to invest work in the case and the greater the risk that the objective is not reached and Metso does not receive full compensation for its work. Difficult cases are balanced by easier cases, but the risk remains. Secondly, as the process is optimized with the help of the software, great gains are first reached with a reasonable amount of work. As the process, however, approaches optimal values it is more and more difficult to reach remarkable improvements. As the client is paying for improvements, there is a risk that the business becomes less and less profitable for Metso. The clients like to take the existing level of performance as the baseline rather than their situation before the use of the software, and so negotiations about compensation tend to become increasingly difficult for Metso in the long run. The short quote from boundary crossing laboratory session 14.10. 2003 below shows how the participants saw the problem.

Head godfather: *"After we have reached the phase when we have passed that level, the performance values are so good that it is hard to improve so radically."*

Local godfather: *"The bonus area* [the performance values of which Metso gets full compensation] *moves in one direction all the time. In one phase the distribution values* [of the parameters to be optimized] *are within so tight limits that it* [a distribution of the values] is *no more a good measure* [of improvement] … *if we continue with the system we now have, the values will always become tighter and so on, and we are soon short of playing chips."*

In the discussions in the intervention sessions, two solutions were constructed for this problem. The first solution would be to divide the development agreement concerning one phase of the production into two parts, 1) maintenance of the software's functionality on the achieved level of optimization and 2) development and further optimization of the production by making changes in the software. This solution could be carried out within the current division of labor based on the phase of production. It resembles the traditional distinction between investment and service and would solve part of the problem. It would, however, diminish the value of the service for the customers and probably not meet their expectations.

The second, more expansive solution would be to initiate a new form of service to analyze the bottlenecks and developmental possibilities in the customer's whole pulp mill or one of its production lines. The specialists from Metso and the customer would jointly do the analysis and plan a "road map" for the development of the client's production process. In this case, Metso would sell its know-how partly as a consultant rather than just as a provider of software. In this process, Metso would identify needs for improvement in the client's production that it could provide for with the help of its software. This new service would actually be an extension and elaboration of the mill audits Metso always carries out before installing the optimization software. If realized, this new service would be a step forward in the integration of Metso's activity with the customer's activity in developing the customer's production process.

The two solutions proposed represent different solutions to the contradiction between valorization and the need for the further socialization of production-related learning and development. The first solution represents what I have described as the vertical socialization of learning and development and a related position-based agency (See Figure 1). It is basically a proposal to redefine the division of labor and responsibility between Metso and the client along traditional lines. The other solution represents what I have called the systemic socialization of learning and development and the related object-based agency. It is clear that collaborative preparation of a development plan would also strengthen the horizontal socialization of learning and development while the parties could transfer ideas for the development of the local production process from other similar factories.

Discussion

The case example shows that the transformation of the provider-user collaboration in the direction of co-configuring is a long, complicated and contradictory process. It is evident in the example that it is especially hard to find an appropriate logic of compensation for a new collaboration oriented to continuous improvement. In the example, the production-phase based collaboration with the clients was encountering some difficulty because of the problem of creating a logic of compensation on the basis of the continuous optimization of separate phases of the production process. The second solution developed in the boundary-crossing laboratory would expand the collaboration to cover a whole line of production and also other aspects of it than the optimization software. It seems that co-configuration production that involves mutual learning has a tendency to expand and probably cannot go for very long without expanding. This observation resembles Hirschhorn's (1986, 124-151) observation that so-called socio-technical factories could either constantly continue learning or would otherwise regress to traditional mass production organizations.

The second proposal developed in the boundary crossing laboratory would create a new level of platform organization in which the various development projects within the client's pulp mill would be connected to an overall diagnostic picture of the problems in the production process and a vision of its future. The concrete work would serve the provider's interest in product development and the client's interest in developing the production process at the same time, thus creating a context for a form of developmental agency that hybridizes agency in developing the local production process on the one hand and agency in the provider's product development on the other.

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