Project's IS and the Process of Procurement

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Abstract

In this article we present the preliminary operationalization of the Project's Information System (PRIS) with the help of Gareis's (1996) "New Management Paradigm". PRIS is project group's own information system, which is tightly connected to the Project-Oriented Company's (POC) ISs. In order to reveal the POC environment's characteristics, we present a case study of the process of procurement in an POC. Then an operationalization of the PRIS is concluded as function of autonomous groups, POC characteristics (i.e. base-organization and networks of projects in turbulent process- and customer-oriented environment) and communication structures between these.

Keywords: temporal information system, group, project

BRT Keywords: HA, GA

Introduction

A project-oriented company (POC) is an organization, which has structures to create, control and support the projects, which produce the customer-oriented outcome of the company. The project-orientation is included in the "New Management Paradigm" (Gareis, 1996), which follows the modern ideas of management in turbulent and customer-oriented environment enhanced with information technology (IT). The new paradigm includes approaches such as Lean management (Womack et al., 1990), Total Quality Management (Juran, 1988), Business Process Reengineering (Hammer and Champy, 1994) and Learning Organization (Senge, 1994). Such organizations produce special customized equipment or products, e.g. ships or buildings. The "New Management Paradigm" searches for solutions to cope with the increasing complexity in the business world.

According to Gareis (1994) "projects are a new strategic option for the organizational design of companies." The project-company is a state-of-the-art organization to the managers of modern companies in which the role of information technology is essential. However, this is not merely question of project management. It is about groups of people performing product-oriented temporal sets of tasks with specified outcomes. Projects are for management and groups are for workers.

We are interested in project work that is performed by (project) group members with the support of the company's other activities (for example accounting and

procurement activities). Earlier projects (or teams) were perceived only as means to cope with something unexpected, something new and unique (Galbraith, 1973). Often the purpose of a project was to solve a crisis of some kind and then return to the "routine" in the work organization. The management of variances by a group is familiar in the sociotechnical approach (Buchanan, 1979, Mumford, 1983). The act-oriented approach (Eriksson and Nurminen, 1991) state that only the human actor is capable of responsible actions. Thus the ISs will be studied inseparably with the group's whole work activities performed by the roles taken by individuals (Nurminen and Forsman, 1994). The management part is not forgot, but the emphasis is not on the management of the POC, except on the project group and its relations to other organizational units in the company and related ISs.

In this article we concentrate on projects which are undertaken by organizations in order to deliver far-tailored products. We exclude all the projects which meaning is to develop organizations own activities or projects that do not have an external customer outside the company. The projects we are interested in have a project group which is mostly gathered from inside the company, but which is in close cooperation with customer and different subcontractors.

In general the key characteristics of project are a) uniqueness, b) temporality and c) group work (Tuomisto and Vesiluoma, 1998). The project implies a complex activity that begins and ends. In some ways such settings are always unique. There do exist some routines as well, but in general either the size is quite large, time span is up to years or activities to be performed are so complex, that the concept of routine work does not help. Project always starts from one point and ends in another, so it is temporal structure in a company. Project groups implement the projects. We emphasize the key characteristics of project and group work with relative autonomy according to group-centered approach. We analyze the requirements derived from these assumptions to the work organization and related ISs in an organizational setting.

There are several automated ISs introduced to support the project work. The "New Management Paradigm" introduces the modern ideas of management, which are not fully operationalized in many of the ISs. Often the perspective remains managerial and from a single project. Jaafari and Manivong (1998) have approached this problem with introducing smart project management information system (SPMIS). The SPMIS is their solution to manage the organization in a very turbulent environment (ever-increasing complexity and uncertainty, high time and money pressures, etc.) Weiser and Morrison (1998) have thought about how the project information should be collected so that people external to the project can retrieve and apply it to future tasks.

In this article the object of analysis is the whole company and its project-business structure. Although ISs and projects have been studied a lot, we contribute group-centered IS requirements for project-companies, which wish to exploit fully the new management paradigm, the essential evergreen features of project and group work.

The aim of this study is to deepen the understanding of project-oriented company's ISs and enforce the IS requirements generated by the key actor, an autonomous project group. Interesting properties of the object of study are the temporality, the uniqueness, and the relationship between the organization and the group work structures. The following research questions arise:

1. Can project group be studied in terms of organizational autonomous work group?
2. Is a project group's own IS a useful concept? What consequences POC environment has on such a system?

3. If 1) and 2) are agreed, then: How are the project group's IS and organization structures connected?

In short, we need to manage the temporal ISs as such and as a part of organization's ISs. The article continues with a introduction to the background of this study. We argue that several approaches imply that a project group needs its own IS in project-company which we call PRoject's IS, e.g. PRIS (Tuomisto and Vesiluoma, 1998). However, even though the projects need their own ISs, they are not separate from other projects' ISs or the ISs of the whole company. The interdependencies, i.e. the networks of projects are included to the study. The case study is analyzed with the ONION-model (Kortteinen et al., 1996) to produce a rich picture of a POC.

Project-Oriented Company (POC)

Structure of the POC

Artto (1998) defines a project(-oriented) company as a company which has projects in its product line and outputs typically as delivery projects. The organization in a project company can vary from slight project orientation (projects are applied in addition to the traditional hierarchical line organization) to flexible network like organization (Gareis 1994). Gareis also writes (ibid.):

> " The more projects the company performs simultaneously, the more differentiated becomes its organization and the higher becomes its management complexity. This complexity results from the complexity of the individual projects as well as from the dynamic relationships between them."

Artto (1998) divides the structure of a project company into two different types of structures: the company structures and the project structures. The company structure consists of business units (or resource pool units). The company organization units own the resources of a company. Its project structures represent descriptions of the work to be done in a project. The company structure will provide and assign the implementing resources to the projects.

Gareis (1994) introduces the structures of the project-oriented company. It consists of 1) base organization, 2) networks of projects and 3) projects. Network of projects consists of projects performed simultaneously by a company. From these we get the levels of the project business company. The base organization gives supportive services and resources to the projects. The networks of projects need to be controlled and coordinated to work effectively using the resources of the company. Finally there are collection of single projects which all have their unique objectives to be fulfilled.

A project-oriented company exists to deliver customer-oriented products by a production line, which consists of projects. All of these projects have their own temporal structure, which consists of the resources from the company structure. The company structure also operates as integrative structure for the project company. It consists of strategic centers, project steering committees, project resource pools, and centers of project management excellence. As Gareis (1994) says, many of these integrative structures are communication structures rather than organizational units.

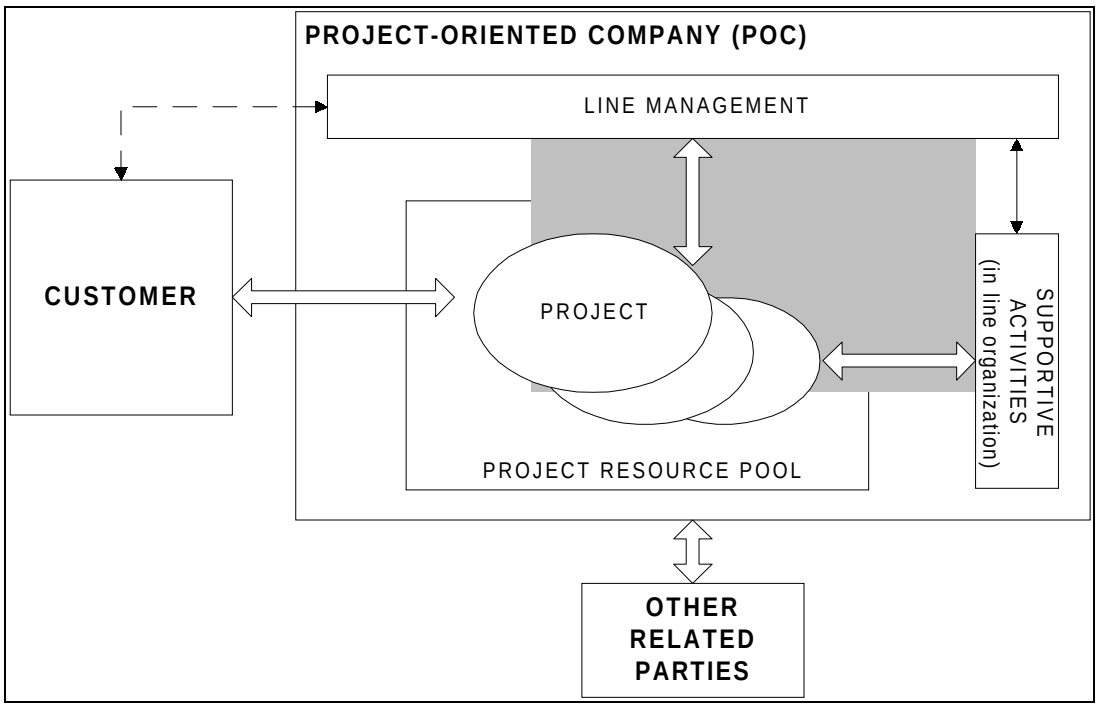

Figure 1: Project Oriented Company (adapted from Tuomisto and Vesiluoma, 1998, p. 895)

In the Figure 1 there are introduced one model of project-oriented company. The base organization consists of line management (general and strategic management of the company), project resource pool (normally departments etc. to where the peoples working in the projects are hierarchically situated in the organization) and supportive activities. The support activities are like accounting, procurement, office help etc. These are activities that are like "outsourced" from the projects because it is no use to establish these activities for a single project except as a supportive service for several projects.

Project structure consists of separate projects which from the point of view form the network of the projects and they must be managed both in the single project level and in the company level. Now we have introduced project structure and base structure of a POC, but still there exists one interesting thing. It is that grayed area in the Figure 1. It is the border between single project and base organization. It is the place where the communication is extremely essential to get the POC work as a whole.

Projects and processes are easily mixed. However they have a basic difference: process is continuing activity, when the project is temporal activity (Pelin, 1999). The activities in a project can be divided to different processes. For example in every project in the case example (introduced later) there is process of procurement. This process exists all the time as part of the line organization, yet the projects, which this process serves, are dependent on it but also conditionally autonomous. Thus we are in terms of autonomy and group work looking for rules of behavior between these two human activity systems, which are called project and line organization. We believe that great potentialities lie within the inherent capabilities of the human actors and more particularly in the social communities of work practice, that is in human activity systems (Checkland and Holwell, 1998).

Projects and groups

The project culture requires that the group work issues of social and technical nature must be established at the organization. This requirement can also be derived from the historical facts. Previously projects or teams were for special use only. Now they have become more “real” and they exist all the time in project-oriented companies. In the early days of computer-based ISs, every functional work unit would be appointed an IS of its own. This is a functional requirement, which is supported by the sociotechnical approach (see Mumford, 1983).

In order to use the competitive advantage of the project organization, the managers have to deal with management issues of knowledge, communication, commitment and empowerment (Turner, 1993). Further managers must deal with relationships between the group, other parts of the company and customers, which include concepts of process-orientation, interorganizational relationships, organizational learning and quality management. It seems that the task of the managers is clear, yet exhaustive and extremely challenging, which also is true for the work of the project group members!

From a system viewpoint a project is a group of skillful people with inputs, conversion activities, and outputs. The group can be studied as a black box from the outside and concentrate to the boundary, management and processes. On the other hand, we can analyze the internal behavior of the project. The group notion also proposes a full social unit with all required resources allocated to that project group. Sociotechnical approaches suggest an autonomous group to be the central work unit (Buchanan, 1979, Mumford, 1983, Susman, 1976). With the autonomy comes also requirements for responsibility and accountability in the IS, i.e. the self-management (Nurminen and Tuomisto, 1999). The self-management, or self-regulation of a project group (e.g. Hackman, 1990, Janz et al., 1997, Navarro, 1994) study well the internal management, but they seldom have any suggestions to the ISs. Further, an autonomous group must be provided with an autonomous group’s IS (Nurminen and Tuomisto 1999, Tuomisto 1999). It is required also in order to the group to be able to participate in the development of its work effectively and efficiently (Kirveennummi and Tuomisto, 1998).

Project groups are conceptually close to teams (Galbraith, 1973). The team notion emphasizes the criticality and uniqueness of action and thus they are built up to deal with specific problem situations (Johansen et al., 1991). The virtual team notion is often used in high-technology environments (Lipnack and Stamps, 1997).

We see project groups as capable of deployment and development of highly autonomous action. The result of this is a requirement for project group's own information system, PRIS. The social interpretation of ISs and inseparability postulate suggest similar system in the sociotechnical spirit (Nurminen and Tuomisto, 1999). Thus the project group’s IS is similar to AGIS, autonomous group’s IS. The autonomy of the group is enhanced by the static and dynamic perspective on the border, and the internal activities of the group. Together with the role concept these three components are the key elements of the AGIS. The role concept helps to analyze the different types of action, e.g. performance, management, and development in relation to actors themselves. We will apply here the AGIS framework, which contains inseparability, responsibility, accountability and sociotechnical principles.

The "New Management Paradigm"

Gareis (1996, 687-689) introduces a "New Management Paradigm" and its operationalization in the POC. The "New Management Paradigm" consists of the new management approaches such as Lean Management, Total Quality Management and Learning Organization. In order to cope with the new management paradigm, following seven items must be operationalized (ibid.):

1. Organization as Competitive Advantage in the POC: Because of projects POC is continuously adapted according to new competitive requirements. The POC has a lean base-organization (company structure) and variable amount of project-organizations (project structure). The company structure elements are rather communication structures than traditional departments.
2. Empowerment in the POC: Project autonomy and project team members have to be empowered.
3. Process-Orientation in the POC: Project-phase-structures are process-oriented. Project management is a sub-process of a project.
4. Team work in the POC: In the POC not the hierarchy but communication structures perform integrative functions. Real team work is needed in projects to create added value. Also representatives from clients, deliverers etc. might be considered project team members.
5. Continuous Organizational Change in the POC: Individual and organizational learning. It is important to reflect and transfer the individual and team experiences (gained in projects) to the organizational know-how basis.
6. Customer –Orientation in the POC: The success of the project depends on the quality of the services performed and the acceptance of these services by the customers, financiers etc. As a customer must also be recognized the internal project owner.
7. Networking with Clients and Suppliers: Traditional hierarchical structures do not exist any more. In the project works representatives of the client, the general contractor and the subcontractor.

Although Gareis (1996) operationalizes the "New Management Paradigm", he prevails the market and management view on the project company. Here we are more interested in the IS support of the actual project work and the relationships between the project and the base organization. For example we aim to show how computer-based ISs are related to the fact that "project autonomy has to be promoted" (ibid., p. 688).

According to our framework the seven items can be seen either a) as an essential part of the internal project group activity, or b) as part of the base organization's performance and management, or c) as a joint "venture" where both the parties must participate actively. We label the categories as a) project group, b) base organization and c) communication. The three categories will be used as a model to point out the requirements of PRIS in a project-oriented company.

Project's Information System (PRIS)

Project life cycle and project group's autonomy formed the basis for our study of the problems in current projects within organizations. We have observed many cases in such

organizational settings, and they have showed inefficiency and blurness in deployment and development activities. Problems relate either to the internal performance of the group or external activities, i.e. the cooperation between project and organization, or both. Many of the severe difficulties were in the area of starting or ending the project and most of them were related to the transferring the knowledge to other peoples in the company.

Tuomisto and Vesiluoma (1998) have provided a preliminary analysis of problems confronted with projects in an organizational setting. They also suggested some properties to be included in the project's IS (PRIS), e.g. more concrete coupling of group's autonomy to the IS design. PRIS consists of three elements, which from the basis for appropriate support for project group's performance. They are temporality, support activities, and autonomy. Temporality aspect gives concepts for companies to deal with project-based sub-systems, that is project groups. Support activities form an interdependent environment in the organization and across the border between company and project. Finally, autonomy tackles the project group's empowerment issues. Flexible and adaptive, high autonomous project group requires properties in organizational setting and IS, which have to be dealt with consciously. Otherwise, the result (PRIS) could easily turn out to be preventive rather than supportive in regard to group's properties.

So PRIS is a point of view of a single project to the data, information and their management in a POC. We can think that every project has its own PRIS, which consists of its own information etc. The rules how to handle the information are common for all projects. But as already from the Figure 1 can be seen, in the POC there are also base organization and not only one project except a network of projects so the PRIS can not be separately and not having connections to the POC's other ISs.

POC performs "endless" operations in contrast to project organization's temporal nature. However, projects do have certain discretion in their work, which demands a more detailed examination of the project life cycle, connections to company structures and connections to other parties (i.e. customers). Inside the company, project and organization structures have two kinds of connections: managerial and supportive.

The temporality is the most significant difference between company's and project's performance. The other is uniqueness. Also other constraints are specified in more detail, such as human, material, and financial resources. Project results often as a beneficial change defined by quantitative and qualitative objectives.

The Process of Procurement

Activities in a project-oriented company consist of networks of processes. Such processes are for example: engineering, procurement, transportation, construction and commissioning (Gareis, 1996). Collaboration, coordination and control requirements between the base organization and the projects are high. Next our case study from a POC demonstrates the POC environment and its basic operations and project activities. We present with the help of the procurement process how the base organization and the project group are intertwined in they actions. Further we will derive from the observations made by the group and the base organization members some requirements for project group's and POC's information systems.

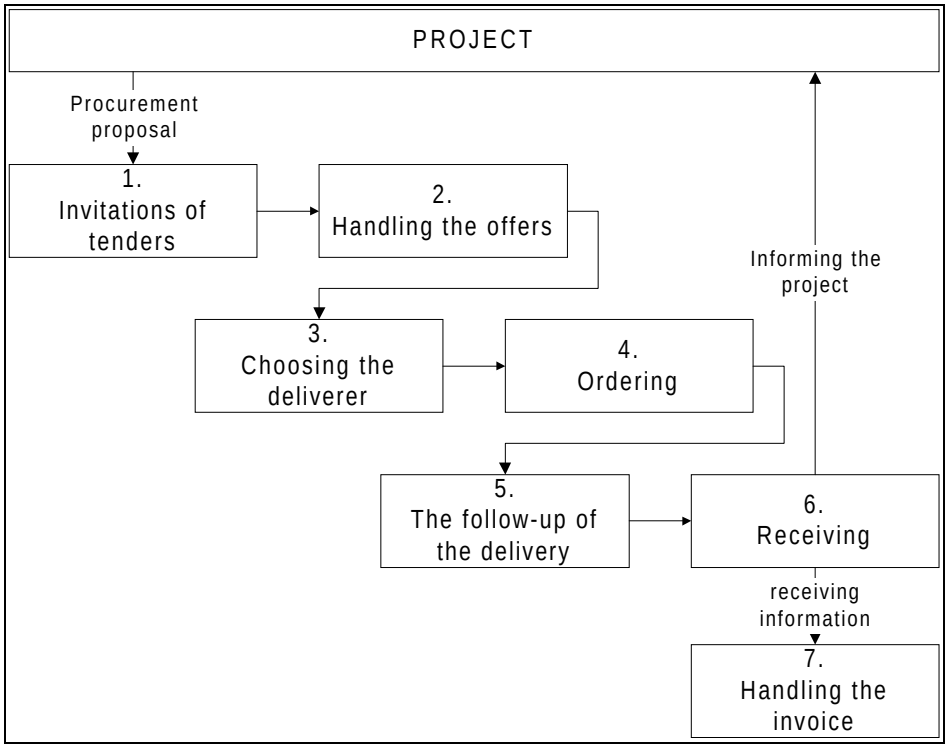

Figure 2: The Process of Procurement

A general process of procurement is shown in Figure 2[1]. It is initiated by an incoming order proposal sent by a project member. Usually in the POCs the procurement is a supportive activity included in the base organization. Thus, the projects can be seen as clients to this support activity. In a non-project business company both the buyer and the "client" are within the base organization. The support activities in a POC have more differentiated role than they have in a non-project business company. This is because the POC's base organization and its support activities have to deal with the traditional organization but also with the projects, which according to Gareis (1996) "are defined to perform unique and complex tasks."

[1] This structure has been defined for the purpose of quality system documentation in the case company by Vesiluoma.

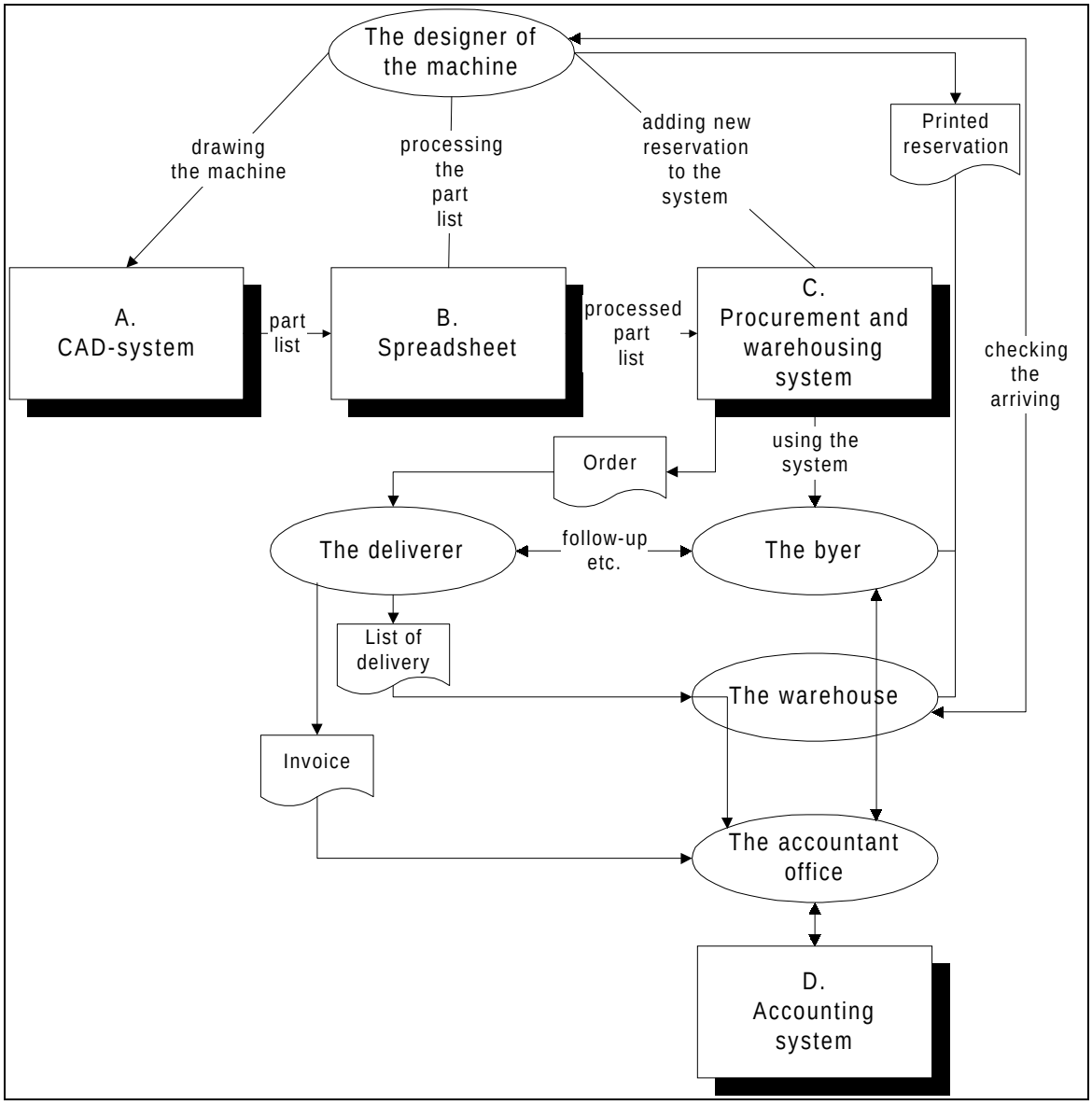

Figure 3: Computerized systems used in CASE

In general there are many variations of acquisition depending on the object of procurement. The object can be for example service, highly tailored system, or just a simple easily definable component. However, the process of procurement normally consists of the phases in Figure 2. The phases 1 and 2 can be bypassed due to long-term contracts with a deliverer, or just because of hurry. The latter is sometimes excused by the high professional of the procurement personnel, i.e. there can be for some special items almost trivial procedures of procurement.

The case presents a company which produces highly automated and tailored machinery systems. These systems are regarded as the project outcomes. For every project is a new project group formed. In order to demonstrate the collaboration between the base organization and the project group, we will concentrate here to the procurement of components. This means that the phases 1 and 2 are often ignored.

In Figure 3 is the system of procurement. The system includes four software packages which are: A) CAD-system, B) Spreadsheet, C) Procurement and warehousing

system (P&W) and D) Accounting system. The sub-systems are not integrated mainly because the procurement and warehousing system is not originally mentioned to be used in a project business company. The actors or related departments and their role in this case are:

1. The designer of the machine, i.e. the engineer (in the project group)
2. The buyer (in the base organization)
3. The deliverer (an external actor)
4. The warehouse (in the base organization)
5. The accountant office (in the base organization)

Next a short narrative is given of the procurement workflow (the text cells describe complete tasks that are performed by one role. The role in charge is bolded, for example tasks 1 to 4 are performed by the engineer):

1. **The engineer** designs the machine and draws it with the CAD-system. 2. In the CAD-system he prepares a part list which he exports to a file. 3. He imports the file to the spreadsheet and from there deletes the lines that will not be ordered outside of the company. Then he saves the file in the format readable to the P&W system. 4. He opens the P&W system and inserts the part list file to the P&W system as a new reservation of components. He prints it out and sends a paper copy of it to the buyer and to the warehouse.
5. **The buyer** checks the new order requests and makes the actual orders with the P&W system. He faxes them to the deliverers, and normally gets some sort of confirmation for the orders. 6. If the delivery is not delivered in time, the buyer checks the status of the delivery from the deliverer. (Normally this happens after the engineer have asked about the order from the buyer, who then contacts the deliverer).
7. When the delivery arrives it is received and checked. **The warehouse worker** marks the delivery to the P&W system and informs the designer or the project manager about it.
8. When the invoice comes **the buyer** checks it and sends it to the accountant office
9. **The accountant office** records the invoice in the accountant system for the project and pays it.

The workflow above is not as fluent as it could be. The reasons for this are manifold including the fact that the systems were not designed for POC environment. However, this was how our project-oriented company managed its process of procurement. Next we will show what observations the group members and base organization representatives made at the POC about their work and collaboration.

The case included numerous interviews with the project group members and the line organization representatives. We analyzed the various problems (or observations on the work and ISs) by using the ONION model (Kortteinen et al., 1996). Shortly, the layers of the ONION model are:

Name	**Explanation**	**Symbol**
Individual	Skilled and motivated individual workers	I
Project group	Professionally and socially well-functioning working unit (Andersen et al., 1990)	P
Unit of the company	The base organization structure (management and support,	U

	communication structures, centers)	
The company	The POC promoting project organization and project culture	C

The ONION model is useful as it helps to put the interviewers' observations into the leveled context with emphasis on work and objectives. The other important issues is that the ONION model also states that all the levels of ONION have equal importance. For example a problem situation reported by an individual could be search for solution at several levels either with or without computers.

As far as we are concerned we need to find out what happening inside the group and in the base-organization, and what issues are part of the communication between these two parties. Thus the case material have been classified into three functional and organizational categories presented earlier: a) project group, b) base-organization and c) communication. The categorization decisions are based on the socio-technical criteria, which state that "variances must be controlled as close to the their point of origin as possible" and that "information systems should be designed so that information goes directly to the place where the required action is taken" (Mumford, 1983).

Project group

Project group contains the individual and group levels of the ONION model. The case revealed issues that related to either usability problems of the systems or to the work structure, which altogether was poorly aligned to the project organization and project culture.

The project group's attitude to their work be seen from an engineer's comment on the P&W systems usability in project organization:

> "After introducing the P&W system the work of engineers has became much harder than without it. At the same time the work of buyers and warehouse workers has become much easier."

It seemed that the group has not been seen as a group; a socially and professionally well-functioning unit. Rather it was interpreted as an ordinary organizational (purchasing) unit. Temporality and group work were discarded properties in the system.

Temporality, as a one key feature of PRIS, could be supported with empowerment and team work. Also process-orientation has to be adjusted to the internal project performance (the networks of projects and organizational learning is on the base-organization's responsibility).

The group's information system should be able to deal with the boundary crossings, internal activities and self-management (Tuomisto, 1999). The first integrates the group into the POC and it answers to the accountability issues. Internal activities search for the skilled workers in the project group, that are capable to do their job efficiently, especially when "considerable amount of discretion is left to the group" (Mumford, 1983). The self-management is the soul of the project group; the empowered autonomous team, organizational learning and most of all, the will to take the responsibility of managing and developing their own work, i.e. to participate (Kirveennummi and Tuomisto, 1998).

For example the following simple comments could have put forward an organizational change that would have been initiated by the project group within its responsibility and autonomy:

> For the engineers it is too difficult to transfer the information from a CAD-system to the P&W system. It consists of too many phases and it takes too much time.
>
> If a worker records a wrong line to the P&W system he can not delete it. He can only set it to zero. This kind of lines confuse others.
>
> The ideal would be that the engineer can forgot the procurement after he has informed the buyer about the materials (etc.) needed. This does not happen now and he must control that the material comes in time.

The empowerment and team work could help the continuous organizational change (or evolutionary IS development from the IS perspective) to acquire in an effective way the information requirements of the group that arise from the actual use situation. Thus the group, as an autonomous unit, has obligations to develop their work. On the other hand, they also have the right to ask for the base-organization to act on these requirements. For example, at the moment the electricians have to make their own spreadsheets with which they can get prizes to some items, because the P&W system cannot manage every type of components.

The interviews showed that the project members (engineers and mounters) criticized a lot the non-project culture that they existed. Groups and base organization's responsibilities had no clear border, and often the project members had to do checking and controlling on procurements.

Base-organization

This part includes the roles of buyer and after sales representative. The statements from base-organization's management could also have been seen as part of this category. However, their comments were not on the work of their own, rather on the project-oriented company of theirs, that is mainly on the projects themselves. Thus we decided to present the managerial comments in the communication category. On the other hand we took some of comments of the project managers into this category, because they were of the organizational nature.

First of all the organization had not fully recognized the role of base-organization and the networks of projects in a POC. The main components would include project groups, base-organization and border between them. For example the systems were consistently non-project-oriented. They were slightly modified to meet the objectives, but the underlying structure was still non-project-oriented, as can be seen from the following comments by a buyer, an after sales representative and an accountant:

> [Buyer] It is difficult to get history information about single components from the P&W system. In this system there are not any easy to use display from which you could see the history information of a component about its reservations and orders.
>
> [After Sales] The P&W system was not originally meant for a project business use, but normal warehousing and procurement for example in retailing business. Some of the headlines of the system has been changed and in some tasks the program is used against its original idea. For example the selling properties are used as reserving products to projects. Otherwise the program is not tailored. One consequence from this is that the program cannot anymore be used to selling spare parts which is an activity that this program originally was meat to do.
>
> [Accountant] Components that have not been directly bought to any project except to the warehouse are a problem. When they are later transferred to a project (in P&W system)

this transfer does not reach the accounting system. This kind of expenses are manually divided to the projects compared to the size of projects.

In other words, the whole organization tried to cope with the systems and do their work in spite of them. These coping strategies with information systems (Gasser, 1986) are met again, yet we must remember that they are rather counterproductive although the work is done.

The base-organization had systems that were not fully for the project culture nor for the supportive role from a non-temporal perspective (i.e. base-organization has to work with long-term perspective). The work procedures nor the information systems paid no attention to the group border or the autonomy. The responsibility and accountability at the border were not realized. To avoid this, the group's actors and resources must be clearly stated, and the process-oriented activities with accountability must be defined. These two views on the border are part of the group's IS, and they are called as the static border and dynamic border, respectively (Nurminen and Tuomisto, 1999).

Within the autonomy context it is possible to search for solutions that give the group possibilities to, at least, partially manage themselves as a "real" autonomous group. For example some items could be ordered directly by the group (within given limits), and thus support the close relations between the projects and its clients and suppliers. But because the autonomy is always restricted, this is the task for the base-organization to realize the project-oriented company as competitive advantage.

Communication

The term communication refers here to all collective action between the project group and the base-organization. Communication and collaboration between the two parties in a POC has a special role in terms temporality. It is there to make the bridge between the temporal needs of a project and long-term organizational development and learning. In an non-POC organization the communication phase can rely much more on the continuity of the organizational units, and therefore the continuous change factor can be managed by regular basis. However, the POC environment requires that the unique project groups, with always somewhat unique needs, are supported by the communication structures of base-organization, which must reflect the timeliness of the project work. Thus we will show some observations that relate to the communication structures between the base-organization and the project group. Especially we put emphasis on the project group and its autonomy as the right, responsibility and obligation to affect its work.

The communication part relates to each layer of ONION model. At the company level the POC must share the objectives that the company searches for. For example a production manager said that:

[Production Manager] For the engineers the objective is to design as simple machines as possible.

This is because if the machine is simple, it is normally cheaper to implement and to maintain. Also the system created from simple machines is normally more easy to document etc. On the other hand Production Managers realize that the knowledge of engineers is essential in the design:

[Production Manager] The engineers who design the systems should have more accurate information of what different solutions cost. The engineer is in the key position in choosing the components and if he has a good knowledge of prices then he possibly chooses the variation that is best in the sense of price and quality.

These objectives can be sometimes in conflict with the ambitious highly professional engineers, who search for new solutions. What is needed is the group-originated operationalization of Gareis' model. If we take the project group and imagine its information system, that is a PRIS, then we will be able to search for concrete solutions how the phases of Gareis can be operationalized. In terms of Gareis operationalization, the communication oriented observations are more or less all linked to the overall idea, i.e. the "New Management Paradigm". However, we must remember that this conclusion would not have been possible without the two other perspectives, namely project group and base-organization. The former draw the project group and its internal behavior, and the latter showed the features of the static and dynamic border. The dynamic part of the border is now extended to study the communication structures of the PRIS.

The need for a special communication structures that initiate from group and its autonomy and that must be supported by the long-term organizational activities are supported by the following observations:

> [Engineer] We must be provided information about new possible components etc. The buyer has firsthand access to this kind of information. This information should then be distributed to us (the engineers).
>
> [Buyer] When the engineers are designing the layout (of a machine), the information of delivery times of the components is important.
>
> [Engineer] If a component breaks up at a mounting site and the component has guarantee, then we must contact the buyer, who then contacts the deliverer. We hope that we could directly contact the deliverer and discuss about the breakdown, because we believe it would take less time.
>
> [Engineer] Even when you (engineer) record the reservation of material to the P&W system, you must also print it and send it on a paper to the buyer and to the warehouse. If you do not send it to the buyer it is possible that they do not recognize that there is a new reservation.
>
> [Engineer] The current expenses of the project are recorded to the accounting system, yet there is always a couple of weeks delay. Also if one wants to have a status report of the project, the report must be requested from the accountant office (which is always very busy).
>
> [Engineer] The project id-numbers and task id-numbers (a project is divided to tasks with separate id-numbers for accounting purpose) has to be created to all systems separately: CAD, spreadsheet, P&W and accounting system. In addition to these there are many other lists to which these numbers must also bee added to.

As can be seen the comments concentrate on the (assumed) rights, responsibilities and obligations of the two parties. The temporal needs must be prevailed by the communication structures, which should in turn be supported by the PRIS. This would answer to items of empowerment, continuous change, team work, process- and customer-orientation especially with networking with clients and suppliers. Altogether, the base-organization's main concern of the POC as a competitive advantage should gain more concrete interpretation.

The Operationalization of PRIS

At Table 1 are the results of PRIS and Gareis' operationalization. Again, PRIS is examined at three levels: a) project group itself and its role *per se*, b) the base-organization creates the group's relative autonomy, and finally, c) the communication part emphasizes the dynamic boundary between the project group and base-organization.

Gareis' Operationa-lization (1996)	**PROJECT GROUP**	**BASE-ORGANIZATION**	**COMMUNICATION**
1. Organization as Competitive Ad-vantage in the Project-Oriented Company (POC)	Notify projects of the group-originated approach.	**Create communication structures and project cultures.**	Enhance organizational and individual learning.
2. Empowerment in the POC	**Collective unit has the right, the responsibility and the obligation to develop their work.**		Promote individual skills and establish professional social behavior.
3. Process-Orientation in the POC		Establish a clear border between base-organization and project groups.	**Joint endeavor of information and material management.**
4. Team Work in the POC	**Leave considerable amount of discretion to the work group (Mumford, 1983).**		**Resource pool from which the project groups are gathered depending on the situation; the quality of resources that can be used (knowledge, experience etc.)**
5. Continuous Organizational Change in the POC	Individual learning and learning as a team including technical IS issues and the use situation evaluation.	Management of processes and its phases.	Organizational learning, sharing the experiences of the projects, developing the project memory (Weuser and Morrison, 1998).
6. Customer-orientation in the POC	Acceptance of the results of a project by the customers.	Internal standards and quality management.	Include the customers in generally to the projects.
7. Networking with Clients and Suppliers	Support the exchange of professional know-how.	Create communication structures over company border.	**The network of all the projects and persons working in the company.**

Table 1: The New Management Paradigm and PRIS

We translated "The new management paradigm" into IS context with the help of the individual case observations. Each cell in Table 1. shows the pragmatic level objective of the PRIS. We found no strict classes, but rather overlapping management and performance related areas of the POC. The most significant ones are bolded.

The project group category searches for the support of the work group as a whole social unit. The base-organization aims at creating ISs that can be aligned into autonomous teams' systems. The communication emphasizes the continuos change and process-orientation, which cannot be pursued for without team-based effective communication. One reason for this communication-intensity could be temporality. In a non-POC organization an organizational unit would have much more stable conditions to manage the communication issues locally within the group. However, in a POC this must be organized via the base-organization in order to ensure the continuity.

Conclusions

PRIS is constructed upon the group-originated approach (autonomous work group), project-group's own IS in POC environment (including feature such as temporality) and the structures between the project groups and base-organization. From these the three components of PRIS were created: project group, base-organization and the communication. The two first created the conditions for the communication.

It is possible that some of the presented problems in the case can be avoided by for example pure project management or Business Process Reengineering approaches. Even the "New Management Paradigm" will no doubt bring forth some good ideas of the management of the turbulent POC environment. However, we do believe that our preliminary, yet comprehensive POC study showed some good ideas of the project group's information system environment from a work group oriented perspective. The operationalization of PRIS, that is aligned with the content of Gareis' operationalization, shows that a project group's IS is build upon group-oriented approach in organizational setting where the border between group and base-organization must be clear. However, it seems that in a POC the communication structures in terms of process-orientation and portfolios determine whether PRIS will reach its goals.

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