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Building Sustainable Information Systems for Project-Oriented Cross Organizational Collaboration

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ABSTRACT
Shorter development cycles and higher complexity of product development require more flexible corporate structures and cross organizational collaboration in order to gain the required know-how and execution capabilities. To fulfill these requirements, many companies are transforming themselves into project based organizations and abandoning traditional business lines. A project based approach gives a company more flexibility and better utilization of its resources. However, compared to running a line-oriented company, steering project-oriented organizations is plagued by complex planning, staffing and prioritization issues. Even worse, integrated enterprise software solutions for running project based organizations simply do not yet exist. This paper explains how organizations are evolving and demonstrates how sustainable IT systems can be designed to support this evolution.

Keywords
Collaboration, project-oriented organization, Internet based project room, cross organizational value chain

ORGANIZATIONAL STRATEGIES TO COPE WITH COMPLEXITY

Project-Oriented
New challenges of today’s dynamic markets like shorter product life cycles and more client involvement increase the complexity of today’s business environment (Gareis, 2003). As line oriented organizations find it increasingly difficult to cope with this increasing complexity, more and more companies are evolving a project-oriented approach to meet these challenges. Instead of assigning associates to departments, they are allocated to resource pools. New projects are staffed dynamically from these pools eliminating the high overhead of interdepartmental reassignment. Such reassignments are inherently difficult and very slow due to associate resentment and inflexible IT systems. However, if people and IT are prepared for changing tasks, better reaction times and product deliverables are the results.

Cross Organizational Collaboration
Other drivers for increased complexity in the business environment are more interrelationships (co-makership) and the decentralization of organizations (Gareis, 2003). This leads to the situation where a single company is not able to deliver a complete solution, but only one complex part of the whole. In order to create a value chain which delivers a complete product, multiple entities must work together as a virtual enterprise (Kovács and Paganelli, 2003).

Such collaboration efforts are usually very dynamic as more client involvement leads to frequently changing requirements. As these dynamics can be very costly and difficult to manage, the creation of instant cross organizational value chains can help to bring value more quickly to the customer.

As organizations increasingly decentralize, they need to be able to integrate their widely distributed resources in order to successfully complete their projects and fulfill their customers’ demands.

REQUIREMENTS OF SUSTAINABLE INFORMATION SYSTEMS

Complete Support of Project Related Tasks
To enable organizations to run effective projects they need IT systems which support the whole set of tasks related to a project-oriented working paradigm. These include time and milestone management, cost control and budget management, resource and delivery management, etc. It is desirable to have all project related information within one system to be able to
access the project’s metrics at any time.

Additionally, it is very helpful if IT systems support the transfer of results and learning experiences from project to project. This enables organizations to make sound decisions based on upon the successful experiences of other projects (Gareis, 2003). The IT system can accomplish this by supporting the analysis of various aspects of completed projects and assisting in re-using knowledge like cost calculation methods within new projects to gain advantage of the lessons learned there.

![Diagram of Information Retrieval and Business Intelligence](image)

**Figure 1. Requirements (Source: conject, 2004)**

### Instant Roll-Out of Cross Organizational Value Chains

Creating value chains within cross organizational projects is a big challenge for everyone involved (Kalbitzer, Ney, Tonn, 2004). Each project has its own unique requirements and the distributed roll-out, acceptance and adherence of common processes is hard to achieve. To be able to deal with this complexity, managers must utilize best-practices and suitable IT systems during the creation of project processes and controlling structures (Beckett, 2003).

An IT system, which supports the instant roll-out of cross organizational value chains, needs to be immediately accessible by all participating parties. Lengthy and complex registration procedures which are required to enable co-workers to participate in the project could lead to time delays. Running local set-up procedures on their client computers is sometimes not possible due to restrictive corporate IT security constraints. To achieve immediate participation of co-workers, such systems have to be accessible over the Internet via a standard web browser by people or via standard web services for other systems. So as not to conflict with organizational security constraints (or having to reconfigure corporate firewalls), it is very important to avoid the use of proprietary, plug-in technologies within the web application. Such an IT system can be seen as a “virtual project room” or “online project collaboration platform”.

As the system should be available on the Internet and contains sensitive project data, authentication and authorization are important design requirements. Managing many people in such online projects requires a simple way of inviting and registering new users to the platform. This is important due to the fact that not all participants are known at the project start time and new participants have to be added throughout the entire project lifetime. Furthermore, the project administrator usually does not have control over the user’s online profile as the user can be participating in many unrelated projects. This leads to the situation that the user has to register online while the project administrator may only invite persons to a project. It’s up to the person to accept the invitation and register their user account with the project as a participant. Within the projects it is very important that all resources like documents, plans and controlling data are protected by a fine grained permission system. As many parties of various organizations are working within the same project space, it is required to be able to control access to certain information very easily.
Another important aspect of such an IT system is its ability to support an instant roll out of best practices while setting up projects. It should be easy to extract working methodologies and materials from current and former projects. An example of this is an introductory SAP project plan for a medium sized company. Such projects typically follow a very similar pattern consisting of assigned tasks and their relationships to one another. If the IT system supports accessing all project plans of previously conducted SAP rollouts, it is possible to give rough time estimates for the upcoming tasks (having been derived from that task’s average duration in former projects).

**Transparent Delivery Management**

In cross organizational collaboration situation awareness is an important success factor (Sonnenwald, Maglaughlin and Whitton, 2003). It is important to explicitly develop project values like shared behavior patterns and the form of the project documentation to give the project members orientation in all their actions and decisions (Gareis, 2003). Since people are located in different locations there is no immediate feedback provided by the surrounding environment or by co-workers. This makes it difficult to develop common project values. Thus, an Internet based project collaboration platform should make the project transparent to help build a social system between the participants.

There are two main features of an online project collaboration platform which can help achieve transparency. One is the concept of notification and the other is the concept of tracking all online events with an audit trail.

**Notifications**

When project participants are geographically (or organizationally) separated they need to be notified of changes happening in the virtual project room. The IT system should offer both fulfillment and subscription notification services. Using fulfillment services, event initiators may send notifications to the parties they choose. Additionally, participants may subscribe for notifications on interesting events. The system would automatically inform them when any of those events occur.

For flexibility the IT system should also offer the possibility to send notifications via various channels like email, short messaging services (SMS) or instant messaging (IM). Even notifications sent via fax might be required in some cases.

**Event Tracking**

To achieve a certain degree of situation awareness it is helpful to log every event happening within the project room (like user login, document updates or schedule changes). Each object managed on the platform can then be examined as to how it was accessed and updated throughout its lifetime. Events such as 'Read' or 'Download' are interesting to the editor of a document as they show whether someone actually took the time to read what the editor wrote. Such reports provide an important part of the feedback required in cross organizational collaborations.

**All-Encompassing Reporting**

If all project relevant data is collected within one virtual project room it is possible to run reports on the individual project as well as on all projects stored on the platform. For example, it should be very easy to find out all responsible persons for deliveries which have overdue delivery dates.

The reporting ability of the Information System is one of the key factors for leveraging the information stored on the platform. It can enable project managers as well as organizational project portfolio managers to get instantaneous access to business critical information.

**BUILDING SUSTAINABLE INFORMATION SYSTEMS**

**Sustainability through Anticipating Changing Business Requirements**

To successfully deal with changing business requirements, an organization needs to get the right person involved in the project at the right time. Also, realizing fast setup times for very complex projects is a key factor – consider the semiconductor industry where project setup without IT support actually takes several months.

**Providing Instant Access through Leveraging an Application Service Provider (ASP) Model for the Virtual Project Room**

Getting the right person into the project at the right time is only possible if these people get instant access to the virtual project room. The use of Internet technologies like web applications and web services serves as a basis for this, but alone is not sufficient. Running an Internet platform and enabling secure access of various parties is a complex and expensive task.
Operating an Internet platform is not usually the core business of a project-oriented organization. If these organizations use the services of an ASP, disadvantages such as extended setup times and operations costs are minimized. The organization does not have to set up a complex 24x7 hosting environment, or administer a data center for all participating parties. The organization simply rents these services from an application service provider.

Another advantage of the ASP model in such a scenario is its flexibility. As the organization does not have to invest huge setup costs, they can start new projects instantly by simply opening up another virtual project room on the ASP platform.

**Support Fast Setup of New Value Chains through Templates**

Fast setup of new projects can be achieved by reusing existing methodologies and materials from current and former projects. This can be achieved by enabling project managers to mark projects as "project templates". Starting a similar project is done by using a project template as the starting point. Using a template, project plans, folder structures for documents, permissions and all other aspects of the virtual project room are available and can be altered for the new project.

An even more flexible approach is templating parts of the projects instead of the whole. By assembling various parts of different projects, a new value chain can be created.

Managing all projects online and in one place makes this reuse of artifacts possible.

**Sustainability through Use of Open Standards**

The Internet has caused a tremendous growth in the number of open standards and communities that work together on these standards. Thus, organizations have more choice between various open standards and proprietary solutions to enable their IT systems for integration. As proprietary solutions are sustainable only by the originating vendor, many companies find that systems built upon open standards and their supporting communities are generally more maintainable.

**Integration into Various Desktop Systems via WebDAV**

Desktop integration enables the user to seamlessly perform their online project room tasks. This is important to increase the acceptance and usage of the online project room.

One example of such a technology is Web-based Distributed Authoring and Versioning (WebDAV). It is a set of extensions to the HTTP protocol which allows users to collaboratively edit and manage files on remote web servers (Goland, Whitehead, Faizi, Carter, Jensen, 1999). This open standard is platform independent and is supported natively within MS Windows®, Linux, and Apple Operating Systems.

**Integration into Existing and Upcoming Enterprise Systems via Web Services**

Web Services, implementing the Simple Object Access Protocol (SOAP) standard, provide a solution for integrating disparate IT systems. SOAP is a lightweight protocol for exchange of information in a decentralized, distributed environment (Gudgin, Hadley, Mendelsohn, Moreau, Nielsen, 2003).

As the Internet is fairly ubiquitous, web connectivity is feasible between large organizations’ IT systems. Architecting an open and standards based interface between such systems simplifies integration and reduces vendor lock-in.

This can enable fast and flexible integration into existing and upcoming enterprise systems of organizations frequently collaborating in projects.

**Sustainability through Concentrating on Simple yet Powerful Concepts**

The most successful way of ensuring sustainability of an Information System is to build it around a focused set of basic, but substantial, concepts. In an increasingly complex business environment, the Information System has to be readily adaptable to address the current requirements. A system built for supporting line oriented businesses does not inherently provide this ability. Another approach is to model the system with components, which provide structure and functionality tailored to that environment. It is critical, however, that these components are built with the already discussed points in mind if they are to be of use in a project-oriented business scenario.

There are five basic concepts surrounding most of today’s project-oriented and cross organizational scenarios: the organization, the project, the product, the individual (knowledge worker) and the community.
Figure 2. Basic Concepts (Source: conject, 2004)

Organization

Project-oriented organizations run and control projects, own products and employ knowledge workers. Additionally, organizations might staff their projects with additional resources found in specific communities like expert networks. These relationships have to be modeled by Information Systems to help organizations deal with the increasing complexity of their business environment.

Applications like portfolio management, opportunity and goal management, cost control and budget management have to be provided by a sustainable IT system. Much as current ERP systems provide similar applications for line oriented businesses, new IT systems offer tailored support for project-oriented work.

For example, the project portfolio management application enables the organization’s managers to continuously analyze the status of individual projects as well as a set of projects in real time. Trouble spots are instantly identified with a visual representation of the projects' status consisting of various measures like number of tasks overdue, number of risks, trends of “value earned – value burned” graphs, etc. Other named applications offer comparable value at the organizational level.

One important resource of project-oriented organizations is its summarized knowledge based upon the learning experience of its projects. Issues like knowledge management, skill management and resource management become critical tasks.

Knowledge management at the organizational level includes tasks like knowledge creation, administration, dissemination and utilization (Kasvi, Vartiainen and Hailikari, 2003). Building knowledge management into an Information System containing all the relevant data, knowledge creation and administration can be done along with the daily project work, minimizing the overhead of such tasks. Dissemination and utilization are achieved by re-using parts of already finished projects. The organization can profit from the reduced effort to leverage its previously gained knowledge.

As the organization component contains all projects and employees, it is quite easy, for example, to find all employees who have database skills and have worked in projects where full text database searches were created. This is ascertained by querying the employees' skill sets along with documents and tasks of all the projects. Only when combining all the data on a platform can such important information be extracted from the Information System and be used throughout the organization. This functionality exceeds the features of currently available skill databases by adding the whole wealth of project information to it.

Project

As more and more industries turn to projects (Gareis, 2003), a project component should be implemented within an IT system. Knowledge workers participate in projects, and projects very often deliver or maintain a kind of product like a building in the construction industry or a car in the automotive industry. The relations between organizations, knowledge workers, products and the projects should be managed by the IT system’s project component.
The functionality required by the project component is quite broad. Topics like time and milestone management, time reporting, risk, issue and problem management, delivery management, cost control and budget management, project staffing and dynamic workflow management are to be supported by the Information System (Kirisci, Kalbitzer, Tonn, 2003).

Additionally the combination of delivery management with time and milestone management provides an opportunity to leverage transparency within a project. The project manager can attach delivery templates to tasks which he then assigns to project participants. The deliverables are usually managed through drafts and versions where a draft indicates a work in progress and a version indicates a finished deliverable. One criterion to gauge a project's performance is to determine which already overdue tasks do not have versioned deliverables attached to them. Even if such tasks are marked as “100% completed” the lack of an attached, versioned deliverable indicates the true progress.

Product

Projects are goal-determined tasks (Gareis, 2003). Very often, this goal is to create a product of any kind like a car or a building, a software package or a financial report, or any other specialized knowledge set. Additionally, projects may be started based upon information defining the product. Another aspect of products is that they are usually owned by organizations.

Organizations need to manage their products as both a potential target and source for projects. It is helpful to start projects based on configuration, documentation, cost control and budget data of existing products. The data defining a product is collected and maintained in the individual projects (as shown in its contained documents, tasks, etc.). Additionally, it is necessary to structure that data within a product component which provides management functionality like configuration management, documentation management, cost control and budget management.

The IT system should provide an easy way to manage the information flow between products and projects. For example a project for developing a face lifted version of a car can be started by copying relevant parts of the product “car” to the new project “facelift”. During the life of the project, the data will be modified to fulfill the new requirements. After the facelift is finished (the project ended) the modified data has to flow back to the product e.g. new parts of the car have to be merged into the parts list of the car to be able to retrieve the current configuration of the car from the product component.

Individual (Knowledge Worker)

Individual knowledge workers are characterized by a high degree of self responsibility. Usually working on various projects in parallel they have to organize their work themselves to deliver all required tasks for each project in time. To be able to deal with the complexity of such a working environment they need the support of Information Systems. That need qualifies the individual as another component of an IT system.

The individual usually works for an organization. More or less independently of that relationship, individuals participate in projects of their own organization as well as of other organizations. Furthermore, individuals often join communities to maintain communication and knowledge exchange with other individuals interested in similar topics.

To optimally support these individuals, the Information Systems should provide functionality like task management, calendaring, knowledge management, intercommunication and document management.

All these functionalities should be tailored to the specific needs of the individual. For example, the task management shows all of the individual’s tasks in all projects. The individual has an overview of all the projects and can react according to the current situation of assigned work. Additionally, the possibility of easy communication with other individuals participating in the same projects will increase the situation awareness of said individuals. While working on specific project tasks, the knowledge worker can profit from other individuals’ experience through a community, using services like discussion forums.

Community

Knowledge workers may join communities for sharing knowledge and getting in touch with other people interested in the same topics. Furthermore communities may act as marketplaces for knowledge and resources. Organizations searching for specific know how or resources with specific skills can contact communities and try to find them there. Communities are typically built within organizations as well as globally.

To leverage the advantages given by communities, there has to be support by an Information System which provides functionality like community member management, a resource marketplace, skill database, discussion forums and black boards. Member management in a community requires comparable features as projects. It is very helpful to be able to invite people to a community. Instant access, permission handling and notification concepts are other features supporting the “life” within communities.
CONCLUSION

Building sustainable Information Systems which support today’s business scenarios is possible if some basic principles are followed. The use of Internet technologies enables forming of instant cross organizational value chains supported by IT systems built around five basic concepts: Organization, Project, Product, Individual and Community. The common use of such Internet platforms enables all-encompassing reporting and a new level of transparency even for organizations managing a portfolio of projects. The main advantage of an Information System built with these attributes is that its structure inherently supports changing requirements; in fact, it is built for coping with today’s increasingly complex business environment.

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