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Production Planning for IT-Service Providers: An ERP-based Concept

Nico Ebert
Institute of Information Management University of St. Gallen, Switzerland, nico.ebert@unisg.ch

Alexander Vogedes
Institute of Information Management University of St. Gallen, Switzerland, alexander.vogedes@unisg.ch

Falk Uebernickel
Institute of Information Management University of St. Gallen, Switzerland, falk.uebernickel@unisg.ch

Walter Brenner
Institute of Information Management University of St. Gallen, Switzerland, walter.brenner@unisg.ch

Michael Heinz
Swisscom IT Services AG, Switzerland, michael.heinz@swisscom.com

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Nico Ebert
Alexander Vogedes
Falk Uebernickel
Walter Brenner
Institute of Information Management
University of St. Gallen, Switzerland
Email: nico.ebert@unisg.ch; alexander.vogedes@unisg.ch;
falk.uebernickel@unisg.ch; walter.brenner@unisg.ch

Michael Heinz
Swisscom IT Services AG, Switzerland
Email: michael.heinz@swisscom.com

Abstract

Due to the pressure of rising costs and an increase in customer orientation, IT-service providers are forced to professionalize their operations (IT-Production). Using Enterprise Resource Planning (ERP) systems common in real goods production allows to take advantage of planning functions and integrated data management. Since the production planning of IT-Production cannot be addressed by standard ERP functions, an extended concept for an MRP II based production planning and control approach for IT-service providers is developed. For this purpose, the production of a Swiss service provider is analysed and requirements are derived.

Keywords

IT-service, Enterprise Resource Planning, Production Planning and Control, Material Requirements Planning

INTRODUCTION

The demands on in-house IT-departments and external service providers are changing: rising customer and service orientation on the one hand and increasing competition on the other compel IT-organizations to professionalize. IT-departments and IT-service providers are increasingly geared to established concepts from industry (Zarnekow et al. 2006). They are standardizing their services in the areas of so-called 'commodity' services such as data center operations, network and desktop PC support. Thereby, they benefit noticeably from 'industrial' management concepts and methods, such as quality management (e.g. Six Sigma) and mass customization (Böhmann et al. 2005, CapGemini 2007).

The concept of IT-service includes IT-consulting service, software development, system integration, IT-operation and IT-training (EITO 2006). Over the past few years, suppliers of IT-services have undergone a shift in thinking. Until recently, project-oriented services were offered and IT-operations were neglected. Now the focus has shifted to offering standardized service bundles including the provisioning, operations and maintenance of resources such as servers, data storage, networks, workstation systems and applications (Bertleff 2001). Despite an onset of 'industrialization' in the creation of these IT-services[1], a number of challenges remain.

- Greater complexity of production: Increasingly, IT-services are not offered anymore as isolated system-oriented services such as software development, hosting, or desktop PC support, but as an integrated service package for the support of customer processes, so-called IT-products (Zarnekow et al. 2006). This increases the complexity of production as a whole.
- High running costs for production of IT-services: Running costs of production account for a significant share of the total cost of IT-services (Strassmann 1997, Jahn et al. 2002, Thiel 2002, CapGemini 2007). Overall, the share of expenses relating to operations and maintenance of IT infrastructure and application support is estimated to be between 60% and 90%. As against that, a mere 10% to 40% are available for the development of new and further development of existing IT-services.
- Poor utilization of existing production capacities: Running costs in IT-production are partly due to underutilized production capacity, particularly in the area of open systems. While utilization of Intel-based

[1] Providing IT-services is equally called IT-production.

servers averages out of 5% to 15%, even Unix-environments utilize not more than 25% of their capacities (Schmitz 2005). Experts assume the surplus to be as large as 30% to 70% of the total capacity in data centers (Zarnekow et al. 2006).

In practice, usage of the process reference model 'IT infrastructure library' (ITIL) by operative production management is widespread (OGC 2007). ITIL shows deficits, particularly in the areas of production planning and control. However, especially in the production of complex IT-services, it is a prerequisite that production processes of the various production areas such as server management, memory management or network management are planned and controlled across silos (Fürer 1994, Britzelmaier 1995, Zarnekow et al. 2006). Planning and control of IT-production has not been academically investigated so far. Instead, capacity planning of IT-services used to stand in the centre of interest. A number of studies can be cited here (Bronner 1980, Carper et al. 1983, Menascé et al. 1994, Müller-Clostermann and Flüs 2003, Brandl et al. 2007), that were drawn up for planning capacity demand load profiles (e.g. for individual user groups) and to determine resource utilization, using either simulation models or pre-defined resource profiles. However, all of them have in common that they neither take the described production processes, nor production factors of an IT-service provider fully into consideration. For instance, human resources or software licenses are not included, which nevertheless amount to a significant share of total production costs.

This paper investigates to which extent a Material Requirements Planning (MRP) II-based ERP concept can be utilized as a concept for the production of IT-services. The paper is organised as follows. In the subsequent second section, the general concept of IT production and a practical case at a Swiss Service Provider is examined. Afterwards, the subsequent section takes a detailed look at ERP within the context of IT-services. Based on this, conclusions are derived in the last section.

IT-PRODUCTION IN THE AREA OF MANAGED DESKTOP SERVICES

In this section, initially an explanation of the term IT-production is given as a point of departure for the subsequent transfer of the ERP concept. Afterwards, a typical example of IT-production by an IT-service provider is detailed.

The concept of IT-production

A production system combines production factors (input) and a factor combination (throughput) to create an output (Zäpfel 1982). The provisioning of services can also be understood as a production system (Maleri 1997, Bullinger et al. 2003, Corsten and Gössinger 2007). However, the provisioning of services is different from real-goods production because of the fundamental characteristics of services. Services are typically immaterial and integrate an external factor in its production process (e.g. a customer). External factors are a special category of input factors. Internal input factors can be autonomously dispatched by the service provider contrary to external factors which the user of the service introduces, or rather provides, for the production process (Maleri 1997). That is why the service provider merely offers production potential that can be used by the client (Maleri 1997).

Thus provisioning takes place in two stages (illustrated in Figure 1): first the production of provisioning (preliminary combination of production factors) and not until then the actual production together with an external factor (final combination) (Corsten and Gössinger 2007).

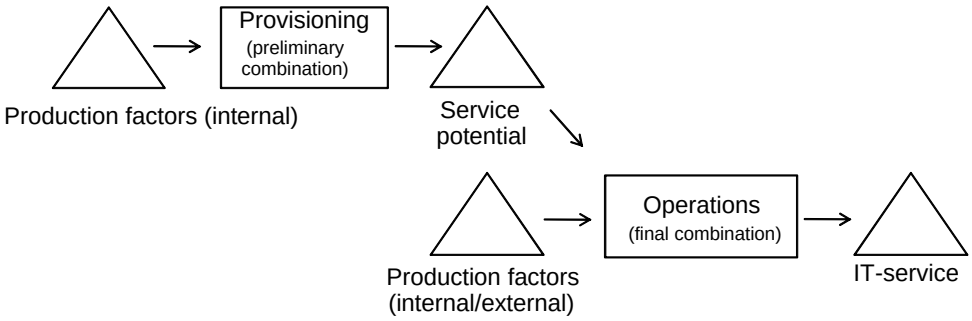

Figure 1: Basic model of IT-production as a two-stage production system based on Corsten and Gössinger (2007)

The production system of IT-production is shown in figure 1. Initially, the provision of the production potential takes place, which can be equated with the production of standby of required resources by the IT-service provider. In this phase, for instance, desktop PC's are provided, user accounts created or memory systems dimensioned. Therefore used production factors (input factors) are, apart from those mentioned resources of

information- and communication technology also manpower (e.g. service technicians), object factors (e.g. material such as printing paper), funds, information and further resources of material or immaterial kind (e.g. data centre plains and software licenses) (cf. Bode 1993). In the second phase of production, resources are kept operational by monitoring- and maintenance procedures (operating activities). Apart from the output of provisioning, the inputs at this stage are also other production factors (e.g. operating personnel, monitoring tools). The result of the operation is finally the IT-service (cf. Corsten and Gössinger 2007). Typical activities of the IT-production of a service provider are shown in Table 1.

Table 1: Examples of provisioning and operating activities of IT-service providers based on Böhmann (2004)

Provisioning activities	
Activity	*Description*
solution concept development	development of concepts for IT-solutions
system development	procurement, customizing and development of IT-systems
system standards and -procedure	development of guides, processes and service standards for new or changed IT-systems
system migration and commissioning	acceptance, start-up, roll-out and introduction of new or changed IT-systems
change- and release management	acquisition, inspection, approval, planning and documentation of changes in IT-systems
Operating activities	
Activity	*Description*
service-level-management	negotiation of quality indicators and their monitoring
capacity management	ensuring of agreed service values for IT-systems by planning, monitoring and adapting of capacities
availability management	planning, monitoring and ensuring availability of IT-systems
problem management	logging, assessment and resolution of faults
emergency planning	creation, practice and application of procedures for the re-start of the system during breakdowns
enquiry management	acceptance, assessment, response or extension as well as monitoring of replies to enquiries by users of IT-systems
data management	data transformation and maintenance (data security, archiving)

Case study: PC-services of Swisscom IT-Services Corporation

Swisscom IT-Services Corp. is a 100% subsidiary of Swisscom Corp., the largest telecommunication supplier in Switzerland. In 2006, Swisscom IT-Services employed almost 2800 people and had a turnover of 836 million CHF. Part of the service spectrum of Swisscom IT-Services is the integration and operation of branch-specific and inter-branch IT-solutions for Swisscom AG and also for external customers.

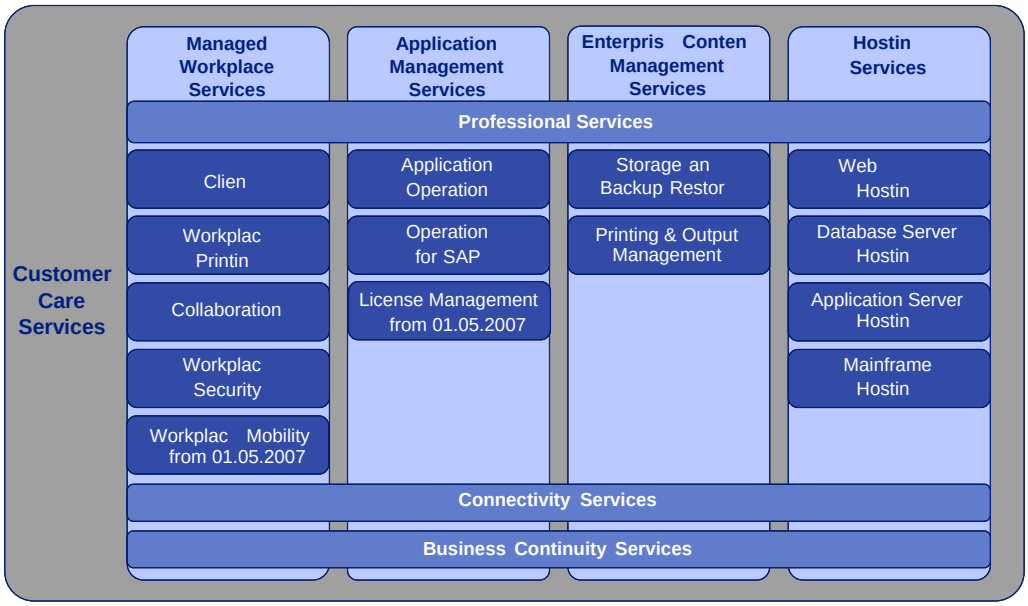

Figure 2: Table showing the service portfolio of Swisscom IT-Services AG (in March 2007)

Like other IT–service providers, Swisscom IT-Services was traditionally characterized by a very individualized customer service. Due to cost pressures, using the approach of mass customization, Swisscom IT-Services decided to offer IT-services that are as standardized as possible and that can be combined according to individual customers' requirements (cf. Pine 1993). Early in 2004, a standard service portfolio was defined and adopted and has been imposed since then on both sales and production (see Figure 2). By this means, the share of standardized services is calculated to increase total turnover by 80% in the long term. Examples of these "Business IT-Services" are clients (operation of a PC for a user, including office and e-mail software) and connectivity (fire walls and LAN or wireless LAN).

At present, Swisscom IT-Services is operating approx. 80'000 work station systems for their clients. This comprises the supply and operation of a terminal (e.g. PC or notebook) for a user and also the supply and maintenance of software on the terminal (e.g. MS Office), the software license (if not provided by the client) and management of entries in user directory (active directory).

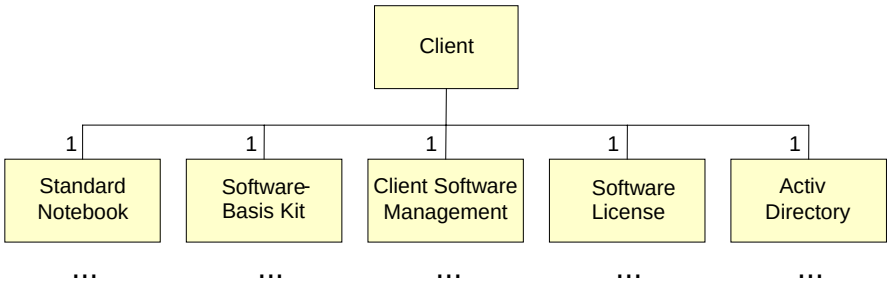

Figure 3: Example specification for Client Services

If the client decides on the Client Service, an agreement regarding the exact scope of service with Swisscom IT-Services is negotiated. This general agreement runs over a period of a few years and contains a rough quantity listing and exact specifications of the service. As shown in Figure 3, this includes selecting the equipment, which is usually ordered by the client's users, the pre-installed and optional software on the terminal and the authorization structure for ordering the equipment (e.g. high-end equipment can be ordered from team leader level and above).

Supply of the service usually starts when the agreement comes into effect, in the sense of binding the client (initial supply) and also through continuous call-off orders during the contract period (e.g. new employee needs a terminal). In the latter case, the order for service follows electronically via the intranet portal of the client. Apart from the supply, the user also has the option of commissioning exchange and removal of hardware and software at the workplace ("install, move, add, change and dispose"). Figure 4 shows a simplified supply process of the client service for Notebook, which was activated approximately 4000 times via an order portal in 2007.

According to a service level agreement, after receiving the electronic order, Swisscom IT-Services may deliver the equipment to the client within ten working days and has to ensure that it is in working order. Initially, the order is checked for completeness against the accompanying data documents. This includes details of the user's location (incl. office number), the user's role and network parameter (e.g. network outlet, IP address). Then the necessary hardware can be configured and a user profile created for the employee in the directory service. The hardware is called up from a central processing unit and transported to a local one situated closest to the client's location. In the local processing unit, the pre-configuration of the user's equipment takes place. For that, the standard configuration is accessed for the client, which was negotiated in the framework contract and which also contains the client's standard software. Finally, on-site installation of the equipment takes place at the user's location, including connection to the local network and the user log-on in the network. After successful provisioning, the user can use the equipment including the linked-up services. From this time the service potential is built up and the phase of the continuous operation begins (cf. figure 1).At the company, Swisscom IT-Services ensures the functional operability of the equipment and the link-up services. The company's activities include the operation of the server, storage systems and networks in the data centre of the Swisscom IT-Services for automatic distribution of the software, the management of the user directories and replacement of equipment in three year cycles ("end-of-life-cycle"). These activities characterize the phase of continuous operation for the client service.

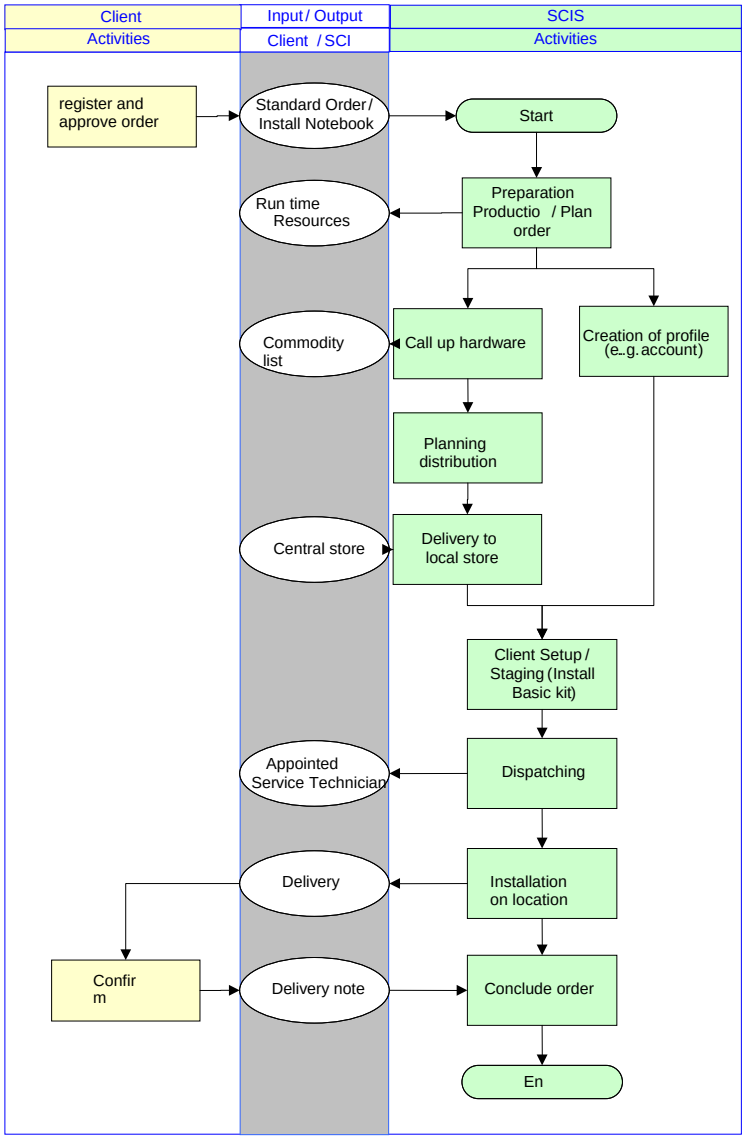

Figure 4: Process of order processing for the supply of a new laptop for a user (building up the service potential for the client service)

ERP IN IT-PRODUCTION

Referring to analysis of the IT-production and the case study, this section investigates a proposal for ERP concept in IT-production. Therefore, the fundamental idea of the ERP is presented first, followed by a planning model for ERP in IT-production.

Enterprise Resource Planning

Since the end of the sixties, production planning and control (PPC) systems in real-goods manufacture based on MRP II and their successor ERP-systems have been researched intensively (Hackstein 1989, Heizer and Render 2003, Kurbel 2003). An ERP-system plans the production process on the basis of expected and existing client orders, considering available resources and supervising production. Its uppermost objective is the profitability of production, i.e. maximizing the ratio between results produced and costs incurred (Zäpfel 1996). Should the required cost information be unavailable at the time of planning, substitute target values, such as minimization of the length of a run or the maximization of capacity utilization will be used (Kurbel 2003). Generally within ERP-systems, the total planning problem is broken down into time-related and factually interdependent sub-problems, which are solved in various planning steps. The quality of the results of the higher planning steps decisively influences the one of the lower planning steps within this hierarchical successive planning framework. The centre of computer-based ERP-procedure is a data base in which the planning and control relevant data are kept integrated (Kurbel 2003).

Requirements for ERP in IT-Production

In the past, ERP was not only considered for real-goods manufacture but also for the service sector (c.f. Cox and Jesse 1981, Dietrich 2006). The use of ERP was for instance discussed in the education sector, hospitals and restaurants. The aim of ERP in the service sector was to improve planning quality, service quality and resource utilization as well as reducing stocks of input material (Snyder et al. 1982). An essential prerequisite for the use of ERP is the standardization of services (Orlicky 1970, Dietrich 2006, Fitzsimmons and Fitzsimmons 2006). Standardized services include descriptions of production factors, processes and their results. By now, several concepts exist that describe services and IT-services in particular and contain descriptions of production factors and processes as well as results (e.g. Maleri 1997, Bullinger et al. 2003, Akkermans et al. 2004, Heiskala et al. 2005, Ebert et al. 2007].

Apart from the description of services, the exact classification of service demands is also necessary because it contributes substantially to improving planning quality. In the planning of services, a stochastic demand is often postulated, and procedures oriented to the past, queuing- or Markov models are used for planning. It happens rarely that demand is deduced from a standardized description of quantity linked directly to the demand for other services.

Tasks of ERP in IT-Production

In analogy to real-goods manufacture, IT-production can be understood as order fulfilment. In contrast to manufacture from stock, in fulfilling orders, production generates individual client requests (Schuh and Roesgen 2006). The example of IT-services of Swisscom IT-Services shows that the client service cannot function without an initial order from the specialist division. In fact, certain services like the procurement of standard notebooks for example could be provided for an anonymous client, although the configuration of a notebook for a user and its operation is only possible after an order has been placed.

Figure 5 illustrates planning steps of IT-production within the production system described in section 'The concept of IT-production' according to their time sequence. In the medium-term, the program plan for production serves to determine production output on the basis of existing and expected client orders. It provides the basis for planning the quantities of resources needed. According to the different phases of IT-production, short-term planning tasks are divided into supply and operation. Whereas planning and control of resource standby aims at an efficient supply of resources, operational planning and control aims at maintaining resource potential. These two tasks are interdependent and this has to be taken into account in planning as well as in control.

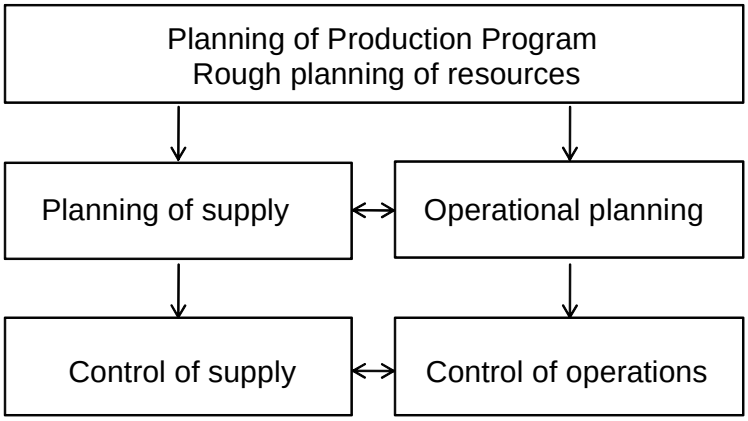

Figure 5: Hierarchy in Planning of IT-production

In the medium-term, the challenge to IT-production is to correctly estimate the demand for personnel and resources standby for supply and operations. Accelerated technical advances in IT-systems make a precise estimate of resources difficult. For instance, in Swisscom IT-Services, PC's are charged off and replaced by up-to-date models ("end-of-life-cycle") within three years and this has to be taken into account in both personnel planning and in procurement of PC's. The replacement cycles for storage-systems are even shorter. At intervals of less than 12 months, a large part of the existing inventory is replaced by newer systems with greater capacities.

Production program planning is the basis for determining resources needed. Its aim for order-production is to determine end products, based on expectations and client orders according to kind, quantity and time frame (Schuh and Roesgen 2006). In IT-production, program planning account has to be taken of existing client

contracts and extraordinary effects of first-time supply of IT-services. These may arise in the Swisscom IT-Services, for instance, when a large number of client services have to be supplied within a short time to a new customer. Because of these uncertainties, event-driven program planning makes sense. Subsequent planning for resource requirements has to take place in supply as well as operations. Similar to resource planning for standard products in real-goods production, IT-production can also use descriptions for product structures and processes similar to parts lists and work plans (cf. Hackstein 1989). Such program-oriented requirements-planning for services has seldom been put into practice until now. However, the example of product structure in Swisscom IT-Services' Client Services makes it clear that derived demand dependencies exist. For instance, client services always require a standard notebook and always an operating system license. That makes it a sensible solution to use parts lists for the estimate of requirements.

Short-dated, planning of supply and operation has to take place. Dependencies exist between individual planning tasks that require close synchronization. For instance, demand for provisioning can lead to extra personnel being employed by the company on a short-term basis. Conversely, maintenance windows of the company have to be taken into account in provisioning, as the latter, for instance, cannot undertake any changes on operating resources during maintenance.

In provision planning, the provisioning or rather the removal of the operating resource and its configuration are planned, based on clients' orders. As the client's order arranges not only for once-off provision and configuration of the operating resource but also continued usage, provision planning must also provide for long-term allocation of operating resources. Within the framework of provision planning, it is necessary to first ascertain the operating resource requirements based on the production structure of the IT-service. Taking Swisscom IT-Services as an example, the result of provision planning can be the number of software licenses, notebooks or service capacities required. Planning of the supply- and configuration processes follows, based on the demand ascertained. Planning values for process lead times can be used therefore. For example, the planning value for the supply of a standard notebook at Swisscom IT-Services requires a maximum of ten working days. Depending on the time available for a planned process, some operation cycles can be temporarily suspended. Time-related planning problems can arise from the integration of external factors. For instance, delivery time for equipment at Swisscom IT-Services depends entirely on the location of the client.

Planning of operations is generally comparable to maintenance planning in industry, where both planned and unplanned maintenance takes place (Hackstein and Sent 1992). In the IT division of Swisscom IT-Services, for instance, regular maintenance work and unscheduled maintenance such as the reaction to faults in notebooks or the installation of updates of the anti-virus software is carried out over weekends. Just as in provision planning, in service planning, the client's order must also be considered. If needed to be, the operating personnel must supervise additional operating resources or adjust service times according to IT-services ordered. For this, existing operational plans need to be adapted.

Finally, the client's order is released. That initiates the supply process and then the client's order is taken into production. In production, the order is supervised with regard to quality parameters and utilization of resources.

SUMMARY AND OUTLOOK

In this article, a possible approach to production planning and control for the supply of IT-services is presented. The pressure of rising costs and an increase in customer orientation makes it necessary for IT- service providers to professionalize their production. Existing ERP concepts from industry can be utilized therefore, as the use of ERP-systems for production planning in IT-production reveals a number of potentials.

Production planning and control in IT-organizations is still in its infancy. The approach discussed here makes client-order orientated planning and control of production of standardized IT-services possible. In this way, an improvement in planning and service quality as well as in capacity utilization of production resources can be achieved.

However, it has to be taken into account for further research that ERP systems are usually designed for mass production and are not capable of handling small lots economically. Therefore the described approach is currently being implemented with an SAP R/3 system and tested within the framework of a practice-oriented project in the companies T-Systems (Germany) and Sysko Comit (Germany), the SAP College Competence Centre at the University Magdeburg (Germany) and the Institute for Information Management of the University of St. Gallen (Switzerland).

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