The Implementation Process

17

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A successful implementation of the selected APS is the obvious goal of any organization that has decided to go for a supply chain project. The first section of this chapter details an approach to ensure the success of supply chain initiatives based on the experience of several realized projects. In the second section, an APS implementation project will be considered from a modeling point of view.

17.1 The APS Implementation Project

As an SCM project affects multiple functional areas like sales, production, procurement, distribution or order management (see Chap. 15) the risks involved in such an implementation are considerable. Many enterprises have experienced spectacular project failures due to a number of reasons, surprisingly few of which have to do with the technology involved. Reasons that show up consistently include:

- The business strategy did not drive process design and deployment.
- The user expectations were not met.
- The time to implement was much longer than expected.
- The cost to implement was much greater than expected.

In the following, a proven approach to ensure the success of supply chain projects is detailed. It provides guidance on the five major implementation phases (see also Fig. 17.1):

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- Project definition
- Solution design
- Solution details
- Execution and deployment
- Close.

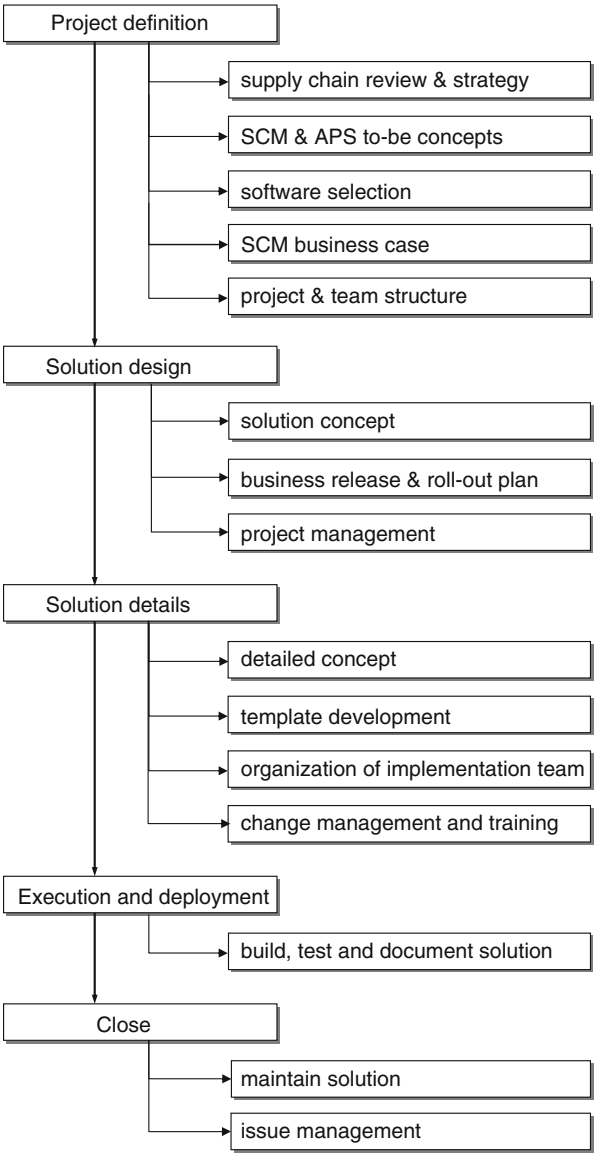

Fig. 17.1 Phases and activities of an implementation project

For each phase we will show the necessary organizational tasks and some proven ways to avoid the major pitfalls. The most important deliverables of the involved activities will be mentioned as well.

The company which has decided to implement the APS will subsequently be called *client* organization or enterprise.

17.1.1 Project Definition

In the *project definition* phase the company's business vision and SCM strategy have to be related to the drivers for supply chain management, which are benefit realization and cost reduction, and subsequently to the goals of the SCM initiative. Examples for goals are inventory reduction, profit optimization or improvement of customer service.

The main deliverable of this phase is the *business case* that will be presented to senior management. A systematic approach to defining a supply chain project including the business case methodology is given in Chap. 15 (see also Fig. 15.2). In this chapter the focus is on the main tasks and deliverables for this process.

- **Supply chain evaluation:** The current processes, organization and systems in use are analyzed and documented. Possible benefits of a supply chain project can arise in different functional areas like sales, production or procurement and include additional revenues by attracting new customers, reducing inventory and procurement cost, decreasing lead times in production and much more. All major improvement opportunities have to be identified during the as-is analysis process, specified and documented according to the company goals and taken into account in the to-be model development.
- **Business strategy and vision:** Based on the company's business vision and SCM strategy the scope of the project has to be defined and documented carefully, both for the required functions as well as for the business processes which have to be changed. No amount of advanced technology can offset the problem of inefficient business processes. The time needed for this activity is well spent as it prevents cost overruns due to scope extensions in future stages of the project. In addition, areas which are out of scope should be documented as well to set the expectations for the implementation results and to avoid later discussions about what has to be included in the project.
- **SCM to-be concepts & APS to-be model:** Solution options and a high-level to-be model are developed based on industry best practices (see also Sect. 2.2.2) and employee suggestions. The project scope is refined and detailed. This activity may include the selection of a suitable software package (for a detailed description of the APS selection process see Chap. 16 and Sect. 17.2). Best practice processes and APS functions are explored to determine the best fit to the future business model. The functions and processes that are to be addressed should be decomposed into lower-level activities (e.g. process: demand management → activities: collect historical sales data, determine forecast proposition, manage forecast entry, achieve consensus about forecast, release forecast to production)

to allow the mapping of these activities to the modules and functions of the selected APS.

Note that the team conducting this phase should avoid to jump right into looking at software functions—the analysis may even yield the result that for major benefits no technology implementation is required at all.

- **Supply chain potential analysis:** Benefit areas are identified and the baseline information is calculated for these benefit areas using a suitable, mutually agreed calculation method.
- **Implementation plan:** Based on the to-be model (possibly including several solution options) a transition strategy including project phases and activities is determined and constitutes to a high-level implementation plan.
- **Time-phased benefits:** The benefits associated with the solution options are calculated over the project timeline based on the implementation plan.
- **Time-phased implementation costs:** Direct and indirect cost are determined including resource requirements and risk estimations. The management should realize that supply chain improvements to achieve strategic business opportunities almost inevitably require a redefinition of business processes. Potential changes may address any aspect of the current organization, including process, technology and people.
- **SCM business case:** The assumptions are verified, combined to the business case and presented to the management.

The project definition phase usually requires a combined effort of internal resources which cover the enterprise-specific requirements, specialists with detailed software know-how and consultants contribute their experience in industry practices. The management should carefully assess the availability of internal and external skills and knowledge. It has to ensure that all skill gaps are closed already in this early phase. As a suitable project structure and team staffing is a critical activity in every project, these topics will subsequently be addressed in more detail.

The design of the *project structure* requires several activities. A project sponsor and the initial contractors have to be found, the team organization has to be determined and the project control and reporting processes have to be defined as well as the project rules. These topics will be discussed in detail below.

The *project sponsor* must have the authority to make changes happen within the enterprise and to maintain a sense of urgency for completing the implementation activities on time. To implement supply chain management strategies successfully traditional cross-functional barriers and contradictory performance measurements (supporting local optima as opposed to a global optimum, e.g. local capacity usage) have to be aggressively removed. In addition the solution strategy must have the support of senior management and all departmental heads affected. Obtaining and maintaining this support is a major responsibility of the project sponsor.

The initial *contractor* relationships must be established. Consulting firms are usually required to provide resources with experience in best practice processes, software features and project management. Software firms can provide resources with detailed technical know-how. As APS are complex software products, the

commitment of the software provider in case of package changes or programming efforts has to be ensured.

The *project control and reporting* processes must be defined, e.g. steering committees, escalation procedures and project management. Clear reporting structures and responsibilities are crucial for the success of the project, especially if several parties are contributing to the project leadership, e.g. different departments or internal and external resources.

Projects can only be executed successfully with an efficient implementation team. In building a team, the technical skills of the team members as well as their characters and organizational needs (e.g. coverage of different departments) must be considered. The structure of the *project team* usually reflects the distribution of responsibilities among the parties involved, i.e. client organization, software provider and consulting firm:

- **Project management:** Full-time resources, both internal and external, are required for project management, quality assurance and guidance. Special emphasis must be put on an efficient integration of the different sub-projects.
- **Team leaders:** Each major process area, usually represented by a sub-project (*functional*: demand planning, master planning or *organizational*: different departments or business areas), requires both an internal and external team leader. They have the responsibility to ensure that all business requirements are covered as well as to supervise the design and configuration of the solutions.
- **Coordinators:** Typically the implementation of an APS radically changes the way in which people do their jobs and interact. With the exception of small pilot projects, successful change projects cross organizational boundaries. The most important team members next to the project leader are therefore the so-called coordinators, full-time team members acting as experts for the enterprise-specific processes. Each coordinator represents a distinct business unit or group affected by the project. Without their participation and buy-in during every single step of the project, an APS project cannot succeed. They have the responsibility to support the design and validation of solution concepts, to improve the communication between the project team and the client organization, to prepare the organization for the necessary changes and, in the end, to achieve the final goal of the project. It is therefore essential to keep the motivation of the coordinators at a high level, by monetary or other means.
- **Functional and process team:** Each functional area's scope has to be addressed by experienced resources. Internal users provide the knowledge with respect to enterprise processes while consultants act as best-practice and application specialists, usually also having an integrative role between the different work-streams. The selection criteria for these team members will be described in more detail in Sect. 17.1.3.

The project management reports to the steering committee which meets on a regular basis, for example every 2 weeks. The task of this institution is to supervise the whole project based on the project reports, to make decisions about major changes in the project plan and to approve or "sign-off" the project results.

The steering committee should be composed of senior management representatives of all organizations and departments involved.

17.1.2 Solution Design

In this phase, the high-level design of the proposed solution is refined and adapted to the selected software in more detail, utilizing the available solution options, if necessary. Key processes and functionalities are validated to identify the potential risks and constraints to the implementation. It is essential that all organizational units which will be affected by the implementation project participate in this task to avoid resistance against the necessary changes. This participation is typically managed by the coordinators mentioned in the last section. Any anticipated constraints to implementing the proposed design have to be assessed. The *solution concept* developed in the previous phase is refined in the three areas *concept*, *activities* and *scope* (see also Fig. 17.2):

Concept

The solution has to be designed considering the future processes, organization and systems:

- **Processes.** As far as the processes are concerned it can be distinguished between *Supply Chain Planning*, *Supply Chain Execution* and *Supply Chain Controlling*. Supply Chain Planning refers to the SCP-Matrix as introduced in Chaps. 4 and 5, including the integrative and collaborative processes. As Supply Chain Planning directly affects operative processes like production (e.g. by generating start and completion lists) or order management (by calculation of ATP quantities and due dates), the transactional processes related to SCM (called Supply Chain Execution) have to be considered as well. Finally, KPIs relevant for SCM have to be monitored and analyzed by Supply Chain Controlling to implement a continuous improvement process.
- **Organization.** The realization of SCM processes will likely require some organizational changes, e.g. the shift of responsibilities, the implementation of Supply Chain Planning groups or even the foundation of a new SCM department.
- **Systems.** The system landscape and the development of interfaces and add-ons have to support the planning and controlling processes while balancing the process needs (which might require a deviation from supported software standards) with the related one-time and on-going cost for development and maintenance.

Mapping the refined solution to the selected software typically results in an adaptation of the concept for two reasons. First, every enterprise has its own specialties as far as their processes are concerned, and no APS will be able to cover all details, resulting in functional gaps. Second, to limit the time and cost for the project very often industry-specific, preconfigured templates are implemented (if available, see also Sect. 17.2). Consequently, most companies have to accept

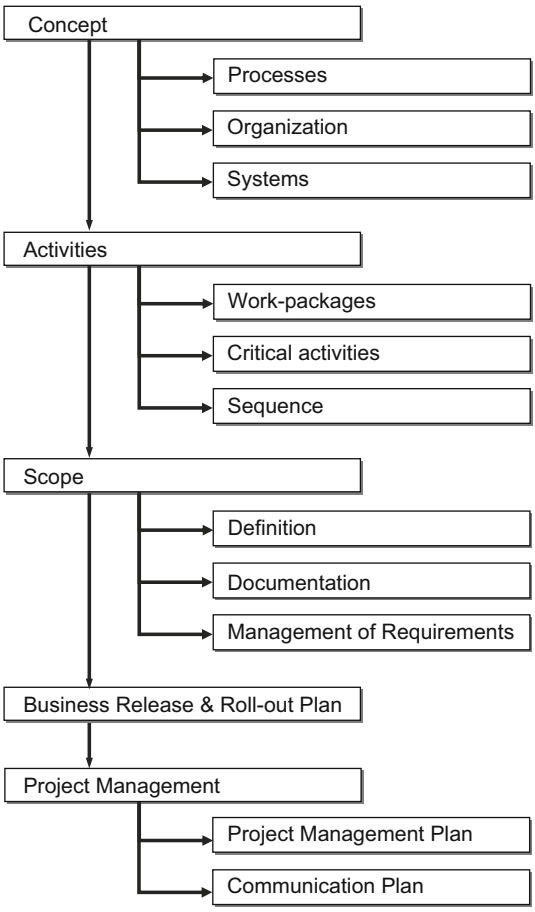

Fig. 17.2 Tasks of the solution design phase. Instead of the task *solution concept* the detailed tasks *concept*, *activities* and *scope* are shown

compromises and trade-offs, for example a redefinition of the project scope or a change of internal processes.

To identify the functional gaps, the key APS functionalities which are needed to support the solution are validated, for example by building a small pilot using a very limited set of data. It is very important to determine the major gaps in this early phase of the project in order to have a solid basis for the cost and risk estimate.

Activities

The detailed concepts are organized into work-packages or activities which are the basis for the high-level project plan. The critical activities have to be identified and sequenced to determine the critical path. Wherever possible, milestones should be included to enhance the visibility of the project development.

The development of a reliable estimation of implementation cost and duration is a key requirement for successful projects. Gartner estimated in 2001 that, for

40 % of enterprises deploying ERP or ERP II systems through 2004, the actual time and money spent on these implementations will exceed their original estimates by at least 50 % (Strategic Analysis Report, Zrimsek et al. 2001). A more recent study for the success rates of IT projects from The Standish Group International indicates that only 39 % of all projects were successful (delivered on time, on budget, with required features and functions), while 43 % were challenged (late, over budget, and/or with less than the required features and functions) and 18 % failed (canceled prior to completion or delivered and never used; see The Standish Group International 2013).

Considering that SCM projects are typically even more complex than ERP implementations due to their cross-organizational character, it can be safely assumed that similar figures can be applied there as well. It is therefore essential that the cost and risk management process is supported by experienced personnel (possibly external consultants) with sufficient know-how in this area based on successful projects.

Scope

Special emphasis should be put on the topic of scope. The scope has to be defined, documented and communicated carefully to limit the expectations to the feasible. How to deal with requirements and expectations will be discussed in more detail later in this section.

Business Release and Roll-Out Plan

To ensure a smooth implementation of the SCM concepts in the *execution and deployment* phase, a suitable business release & roll-out plan has to be developed. A business release denotes a set of functionalities covered by the solution whereas the implementation of a solution or business release is called roll-out.
Business release planning should consider the following approach:

- Start small and simple with transparent standard supply chain processes.
- Develop functionalities for less complex regions first.
- Increase functional complexity and automated planning after learning phases.
- Avoid non-beneficial functional enhancements by stringent scope management.

The roll-out strategy typically has to cover regional areas and/or functional aspects, e.g. roll-out of a business release first to Italy, then to France and Eastern Europe or roll-out of the demand planning and master planning module of an APS (first business release) in a first stage and of the detailed scheduling module (second business release) in a following stage.

Project Management

The implementation plan (including all tasks related to concept, activities and scope) is completed by adding the efforts needed for project management and for a suitable communication plan. Because of their importance these topics will be discussed now in more detail.

Experience has shown that many SCM projects exhibit the same characteristics: budget overruns, missed deadlines and failed organizational expectations. Not all of these can be related to project management problems, but too many can.

The importance of project control can be appraised by the multitude of literature that exists about this topic (see, e.g., Kerzner 2013, Project Management Institute 2013 and Meredith and Mantel 2012). In this section we will give a general introduction and highlight some of the major pitfalls.

Project management activities must be planned to span the complete life time of the project. The control and reporting procedures are essential for the effective management of any project, regardless of size or scope. Key aspects of any reporting procedure are deadlines and an *early warning* capability. The procedures must effectively deal with project work progress, issues and risks. The main project management activities in order to minimize cost and risks are

- To manage the stakeholders
- To structure the scope
- To plan and control the project activities
- To organize the resources
- To assure quality.

The goal of *stakeholder management* is to identify project stakeholders with their specific characteristics to better understand how they need to be treated in order to ensure project success. The tasks are to identify those individuals or groups of individuals that are involved in or are affected by the project, to understand their importance, their interests and expectations and their influence on the project. Finally actions have to be defined to achieve and ensure continued stakeholder contribution.

To *structure the scope* means to divide the project scope into parts and subparts and to assure the integration between the different workstreams. This is especially important for SCM projects where several initiatives are realized simultaneously. An example is the implementation of an SCM concept including demand planning and master planning where the result of the demand planning process is the starting point for the master planning. In such a common scenario the project would typically be organized into the two workstreams “Demand Planning” and “Master Planning”. The project management team has to assure that the solution for the master planning process considers the demand planning concepts and the timelines of this workstream.

The main tool to control a complex project is the *project plan*. It should consist of a project master plan for the whole project, with a limited level of detail, and detailed project plans for the different sub-projects (e.g. Demand Planning and Master Planning in the example above). It is necessary for the project plan to be broken into easily definable phases. Regular updates are mandatory tasks for the project managers. Experience has shown that weekly project management meetings are required to keep the different parts of the project under control.

There are several ways to *organize a project plan*, typically involving software tools like Microsoft Project or Excel. Every project manager should consider the difficulty to change the way the advancements of the project are controlled and should therefore carefully choose a suitable kind of method for himself. Most methods are based on monitoring the critical path, although the major problem, the combination of unexpected delays and dependencies of tasks, is often not addressed

with the right emphasis. Given the nature of implementation projects, unanticipated tasks will come up that must be completed without revising the final deadlines. Therefore buffer times included in the project plan have to be used with a great sense of responsibility and must not be wasted, otherwise delays in the project time lines are unavoidable (see Goldratt 1997 and Leach 2004). Communicating this fact has a top priority for the project leaders, especially with an inexperienced, temporary project team.

The project plan has to consider the required resources for the different implementation phases. Typical implementation phases are

- The creation of an enterprise-wide template
- The roll-out of this standard solution at a pilot site, validating the standard concepts
- The roll-out of the solution to all sites including site-specific adjustments and enhancements.

To ensure the availability of these resources is the responsibility of the project management team.

Quality assurance is based on periodical reviews of the concepts, on the implementation of approval processes and on proactively looking at potential risks. The expected result of all these project management activities is a reduction of cost and risks for the project.

It has been mentioned above that, next to the project management processes, a proper *communication plan* has to be installed to ensure the success of the project. All goals and expected benefits should be communicated to the relevant people, starting with a carefully organized kick-off workshop to create an atmosphere of anticipation and motivation. These activities have to be considered in the cost estimation.

Although the communication of the goals and expected benefits is important, this is not sufficient to create the atmosphere which is required to successfully implement SCM processes. Additional trainings are needed to explain the basic concepts of SCM to the key users in all areas affected by the project. It is essential to create this acceptance, commitment and enthusiasm in the team, in the environment of the project (production planning, order management, sales etc.) and in the supporting management (department managers etc.) in a very early phase of the project by applying the following principles:

- Let the participants experience the benefits of the SCM concepts, e.g. via interactive simulations.
- Demonstrate the (basic) functions and features of APS.
- Provide a clear understanding of the risks involved, especially for the project team.
- Focus on acceptance and commitment rather than on mere knowledge.

The cost for these activities have to be included in the cost estimation as well.

In addition to the kick-off meetings and trainings, periodical workshops with the users should be organized to show the progress of the project and to preserve and improve their commitment. Especially in long-term projects people tend to loose

focus on the goals and expected benefits which might result in discouragement and even resistance.

In every SCM project unexpected issues will arise which cannot be solved by the implementation team itself. Examples for these issues are serious software bugs or unexpected resistance within the organization. In addition to project management it is therefore essential that an issue management process is established, clearly understood by the project management team and then implemented during the early stages of the project. The procedures to be defined are analysis, assignment of responsibility, tracking and resolution.

A very important aspect of issue management is to deal with requirements and expectations. Unrealistic expectations, for example concerning the difficulty of implementing a new concept, and a short-term focus can lead to a shift from a planned implementation to "quick fixes" that do not solve the fundamental business problems. These conditions in combination with the lack of a formal process for defining business requirements often lead to a loss of focus and scope creep, thus drastically increasing the implementation time. This can be avoided by rigidly using a formal process to incorporate user requirements or change of requirements, preferably using the coordinators to filter out less important requests.

The implementation plan is combined with the benefit, cost and risk estimation to form the business plan which is the basis for the final proposal presented to senior management. After approval, the senior management should demonstrate and communicate its commitment and buy-in to the proposed high-level solution throughout the organization.

17.1.3 Solution Details

In this phase the details of the proposed solution are defined and software templates are developed, if appropriate. The project plan is refined and a detailed description of the work packages necessary to complete the project is prepared. This also includes the roll-out and training plans for the sites and users as well as change management activities. The packages are assigned to the required team members and the resulting activities are scheduled considering the availability of the resources.

Detailed Concept and Template Development

The concepts from the previous *solution design* phase are reviewed to gain a full understanding of the implications that the implementation of the solution will have on the affected units and on the organization as a whole. It has to be ensured that the available functionality of the selected software is applicable also on a detailed level, although this should have been tested already in the selection phase by the use of mini- and maxi-prototypes (see Sect. 17.2). All functional gaps have to be identified in this phase.

Typically a *template* covering the standard processes is developed including system customizing and the resolution of functional gaps (see also Sect. 17.2).

An example for this approach is the implementation of a detailed production planning system for a multi-site company. The standard processes which are used in all plants would be considered in the template whereas site-specific enhancements would be developed in the next phase, *execution and deployment*, during the roll-out of the solution.

Organization of Implementation Team

Team staffing is not required in full at the start of the project but typically ramps up in this and in the next phase. If some members are not assigned full-time to the project, this must be considered in the project plan. Even for full-time resources no more than 80 % of the available work time should be planned to allow for travel time, administration and vacation. It is essential that the coordinators are assigned full-time as they should have a start-to-end responsibility for the success of the project.

Experience has shown that SCM projects are typically staffed with roughly an equal share between internal and external resources. The selection and provision of internal project team members is an important step. External experts are essential to provide experience and know-how, but only those who live within the organization can carry the project to a successful end. As the implementation of an APS is an inter-disciplinary effort, the criteria which should be applied to select the right internal people for the core team include:

- Experience: All critical aspects of the project should be covered, e.g. sales, product management, order management, production planning, IT services etc. People with influence in the key areas will be very valuable.
- Skills: Required are advisers who know the business very well and internal consultants who build up know-how which remains in the client company after the project is finished.

For external personnel who are to participate in the project, a similar scheme of criteria should be applied. The requirements include

- Experience: in project management, in change management, in best-practice processes and with the software product
- Skills: in programming and customization of the software product and in the development of requirement specifications, roll-out activities and training of users.

Although it is not possible to staff every project exclusively with experienced people, especially for long-term projects with the inevitable replacement of team members it is important to insist on and control a certain level of experience and skills of the internal and external project members.

Change Management and Training

An important part of any SCM project where external resources are typically employed is the area of change management. The implementation of an APS almost inevitably requires change to an organization's structure and culture. The dynamics of change processes which have to be addressed during the realization phase are

listed in the following (for further information about change dynamics related to processes and teams see, e.g., Hayes 2010, Belbin 2010 and DeMarco and Lister 2013):

- *Shock*: Confrontation with an unexpected event or environment.
- *Refusal*: No acceptance of the need for changing the own behavior to react to the changes.
- *Rational understanding*: The need for change is recognized, but the willingness to change the own behavior does not yet exist.
- *Emotional acceptance*: New chances and risks are identified and the necessity for change is accepted.
- *Training*: Readiness for training and to change the own behavior. New forms of behavior are tested.
- *Knowledge*: Gained experience helps to decide what behavior fits best to the according system.
- *Expertise*: The new behavior is fully integrated in the daily work, accepted and evident.

In addition to the usual problems (resistance to change in general, satisfaction with the status quo, threats to job security and career objectives, etc.), there are two more barriers specific to the implementation of an APS: The acceptance of *automation* and the *shift of responsibility*.

APS are based on problem solvers and optimization algorithms which help to rapidly respond to changing conditions by automatically generating proposals and alerts or even by automated decisions. This has an impact on the daily work of sales people, production planners and other people concerned with the planning process, as the responsibility for a successful planning shifts from these people to the software tool (and indirectly to the people concerned with the maintenance of basic data).

An example for this is a scenario where a production planner of a plant now has to trust the production plan of an APS, thus only reviewing and solving the problems indicated by the software (usually via alerts or messages). The part of the production plan without problems might get directly transferred to the execution. The planner has to assume that the software calculations are correct (which is generally the case) and that the foundation of this calculations, the input data, is accurate (correct lead times, yield figures etc.). This is typically only the case if the people responsible for this input data know about their influence on the overall planning process.

Resistance against the planning tool is an obvious consequence. This problem can only be solved using an appropriate change management approach (communication plan, involvement of employees, rewards and recognition etc.).

There is another aspect to the shift of responsibility, from local to central, which has to be addressed as well. Typically SCM processes require a central planning organization, for example in the areas demand management (consolidation of forecast from different sales organizations, central management of allocations) or master planning (coordination of material and capacity constraints across the supply chain). As a result the scope of the local planners becomes restricted, which is usually not appreciated by the people affected.

The availability and quality of basic data are further major problems in APS projects. An APS has more extensive requirements to the quality of basic data than the old processes and legacy systems which have evolved on-site and which are therefore more adapted to the current basic data situation.

As far as the availability of basic data is concerned, the project team will face the problem that SCM is executed across the borders of departments (or divisions or companies). This typically involves the integration of data from diverse application systems on different databases running on multiple hardware platforms. The consequence is a common situation: The people needed to maintain the basic data do not have the overall responsibility. As a result improvement of data quality is a slow and painful process.

Lack of basic data or poor data quality inevitably leads to delays in every stage of the project plan: software development becomes very difficult, professional tests of software releases are almost impossible and a productive use of the final solution is unlikely. To avoid the pitfalls associated with basic data, the process for basic data maintenance has to be revised and, if necessary, has to be set up right from the start of the implementation project.

The requirements for basic data have to be communicated to all relevant people within the organization. In general, the activities connected with the communication plan have to be continued and intensified. These include newsletters, workshops and preliminary trainings to make the concepts of SCM as well as the selected software functionalities accessible to the users.

17.1.4 Execution and Deployment

In the *execution and deployment* phase the key components of the detailed solution are constructed, tested and documented. This includes software development and customization, implementation of best practice processes and user training. The template designed in the *solution details* phase is enhanced to include specific organizational requirements and eventually rolled out to the different sites. To limit the time and cost for this phase, it is essential to establish and retain the following success factors:

- Focus on the objectives and benefits
- Limit the implementation to the predefined scope
- Show constant support by senior management
- Ensure effective communication between everyone in the project.

The complexity of APS projects is the reason for one of the most dangerous pitfalls in this phase: scope creep or, in other words, loss of focus. This tendency to model and implement every detail of emerging user requirements, in contrast to the approach based on the carefully designed solution defined in the previous phases, leads to drastically increased implementation times or even to the failure of entire projects.

The only way to avoid scope creep is to install a rigid change-request-management process with the objective to validate every new user requirement and to reject (or at least postpone to a later release) the ones that are not critical for the success but mere enhancements. Only the part of the requirements that still remains after this process has to be developed and included into the model.

The development activities have to be supported by a well designed testing environment and a defined test base for the validation of software releases and ongoing enhancements. Especially with regard to a final approval by the client management staff it is necessary to implement a formal test-plan management system with a sign-off process.

The IT infrastructure typically includes:

- A development system
- A test and training system
- A quality assurance system
- A productive system.

The hardware for each of these systems has to be configured to allow sufficient performance, even for the development system. The processes to transfer functional developments from one system to the other, e.g. from the test environment to a quality assurance system and subsequently to the productive system, have to be designed carefully in an early stage of this phase.

To avoid problems during later stages of the project, it is necessary to set up a sufficient documentation system as well as to insist on a complete and precise documentation from the start. A professional *document and knowledge management system* supports the implementation efforts as well as the development of training materials and, in the next phase, the setup of a support and maintenance organization. Although this statement seems trivial, it is much too often ignored, especially in the first phases of the project where the complexity is still limited and the need for a rigid documentation as well as for an extensible documentation system is not yet coercive. In addition to the technical documentation the minutes of every important or official meeting should be maintained in the documentation system as a future reference.

The user training is based on the project documentation developed in the phases *solution details* and *execution and deployment*. It has to address the to-be processes as well as to cover all software functionalities required for the daily business of the users and should include hands-on exercises using a training system. In addition the training team should provide support materials such as desk reference manuals and self paced training exercises. The user training has to be performed timely and with sufficient effort, especially in APS implementation projects, as insufficient knowledge transfer can impede the progress of the desired business solution.

As mentioned in the *solution design* phase the work progress as well as the budget have to be monitored and controlled carefully. To maintain and increase the acceptance for the project within the organization it is important to communicate all success stories, goals achieved and milestones reached on a regular basis as part of the overall communication plan.

17.1.5 Close

This is the period late in the project life cycle during which the post-implementation processes are planned and organized:

- Maintenance of IT environment
- Maintenance of solution
- Issue management.

The maintenance of the IT environment (e.g. productive system, quality system, interfaces etc.) can be carried out by the IT department of the client organization. Alternatively, an outsourcing solution can be considered.

The team responsible for the maintenance of the solution (i.e. the functionalities covered by the APS system as well as the stability of the software itself) should already be established at the end of the *execution and deployment* phase. It should consist at least in part of experienced team members who have participated in the implementation of the solution. This team should also manage all issues which might arise after the go-live of the project, for example user requests, bug-fixes or performance problems.

The documentation has to be finalized and signed-off by representatives of the client, typically the coordinators.

Ultimately, the measures for the performance benefits of the business solution have to be installed and the solution has to be officially approved by top management, closing the implementation project.

17.2 Modeling Phases of an APS-Project

The last section, introducing the five major implementation phases, was primarily focusing on project management and change management issues. In the following, an APS implementation project will be considered from a *modeling* point of view. The different types of models will be sketched that implicitly and explicitly represent the supply chain and its planning system during the implementation life time. A "guideline" for modeling and integrated planning with APS will be given by referencing the chapters of this book that are related to the respective modeling phases.

17.2.1 Major Phases

As a quintessence of Sect. 17.1 one can state that two decisions of general principle have to be made in an APS implementation project: The first one is to check whether a computerized support of planning is useful and necessary at all and—in case it is regarded beneficial—to decide that the APS market should be evaluated thoroughly. The second one is to select a certain APS for the implementation. With respect

to these decisions, from a modeling perspective three major phases of an APS implementation project have to be distinguished:

Evaluation phase: In the evaluation phase a concept for the company's (client's) future planning activities has to be developed *independently of a particular APS*. This concept gives a first impression of the crucial planning tasks and coordination links.

Selection phase: In the selection phase there is a common belief that an APS might be helpful for supply chain planning. However, among the many systems on the market the one has to be chosen which best fits the company's needs. From a modeling perspective, it is essential to evaluate the planning capabilities *of each potential APS* as carefully as possible in order to recognize functional gaps *before* an APS is bought. As Chap. 16 has shown, there are several options for evaluating the functionality of an APS, differing with respect to the evaluation time, the evaluation costs and the reliability of the insights gained. In the following, we will concentrate on the most reliable option, the prototyping, which should only be executed for one or just a few "hot candidates".

Introduction phase: In the introduction phase the decision for a single APS has already been made and this decision usually will not be revised because of the high investment costs necessary. Thus, for a given APS executable supply chain models have to be designed which support the long-term to short-term planning tasks introduced in Fig. 4.3.

Note that only at the end of the introduction phase "executable models" of the supply chain exist. Supply chain models of the preceding evaluation and selection phases are not designed for a final application. They represent preliminary, aggregated views of the supply chain and merely support the decision processes concerning the introduction of an APS in general and the selection of a particular APS. Nevertheless, after these jobs have been accomplished successfully, the insights gained will not be lost but can provide guidelines for the final implementation process.

17.2.2 Steps of Supply Chain Modeling

Figure 17.3 shows the various models and modeling steps that lead to the final application of an APS. The models are assigned to the three major phases mentioned above. During the following discussion of the respective modeling steps a reference to the corresponding book chapters that offer more detailed descriptions of the modeling processes is given.

In a first step the main planning tasks with a high potential for improvement have to be identified. The ones that show strong interrelations and a similar planning horizon have to be considered simultaneously and should be combined to manageable planning modules, each of them being in the responsibility of a specific planner or planning department (see Chap. 4). Since supply chain planning occurs on several

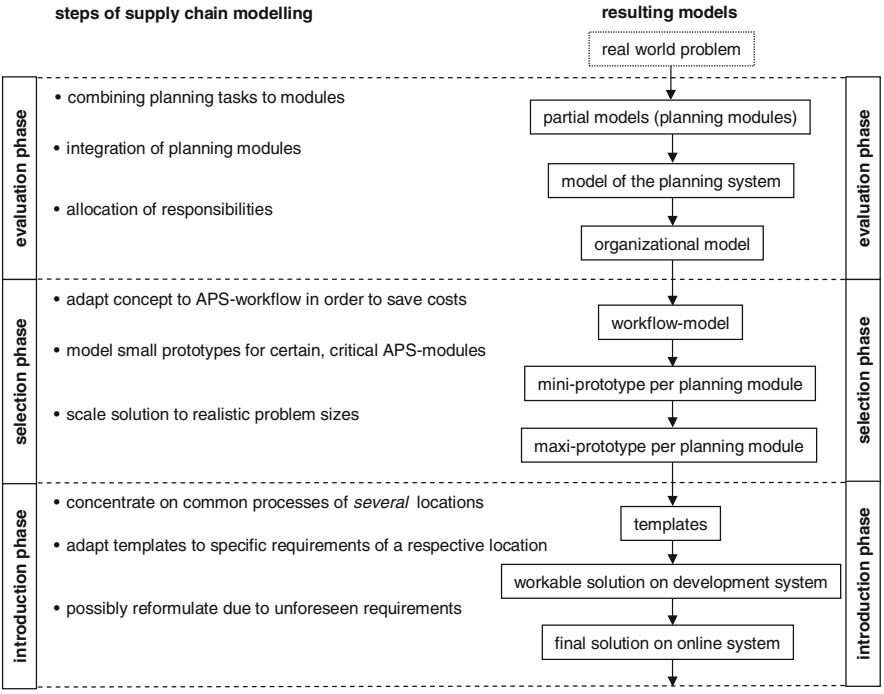

Fig. 17.3 Modeling phases of an APS implementation project

planning levels with different planning horizons, the resulting planning modules are merely *partial models* of an overall planning system, in which the individual planning modules are in a (weaker) mutual interrelation.

These planning modules have to be coordinated so that the supply chain as a whole shows the best possible performance and the highest possible degree of integration. In order to achieve this coordination, various information has to be exchanged between the planning modules (see e.g. Fig. 13.1). For example, directives of higher-level, coordinating planning modules (e.g. Master Planning) are sent to lower-level, coordinated planning modules (e.g. Production Planning or Distribution Planning) or feedback of lower-level modules is sent the other way round. Therefore, a *model of the planning system* (i.e. of the planning modules and their mutual informational links) has to be developed which defines the basic data flows between the different planning modules. Guidelines for installing these information flows by means of hierarchical planning are given in Chap. 4. At this early stage of a business process re-engineering project important aspects of planning, like the technical practicability, can only be assessed to a certain extent. Thus, the resulting model is a high-level design of a planning system that has to be adapted in later stages though its essential features should remain unchanged.

In order to prevent potential solutions from being excluded too early and to ensure that an "ideal" planning system can be developed, existing organizational structures have been assumed to be changeable during the first two modeling steps. Only in the subsequent step, the model of the planning system should be adapted consciously. Within this third modeling step responsibilities for the individual planning tasks and planning modules have to be assigned to the existing or future organizational departments. All in all, the resulting *organizational model* of the planning system may deviate significantly from the preceding rough planning concept. Note that hierarchical planning, as introduced in Chap. 4, can also respect such organizational constraints, and thus, can be used to derive and compare both the "ideal" and the organizational model of the future planning system.

This organizational model is the basis to decide whether the *selection phase* is started or not. In case it is, the following three steps of SC modeling should be executed for only the few APS that are short-listed.

In order to save time and money during implementation, APS vendors sometimes provide (industry-specific) "workflows" for their systems, i.e. planning concepts with pre-configured data flows between the software modules. These planning concepts are designed to meet the requirements of "typical" companies of a respective industry or line of business. To be generally applicable they also are, as far as possible, independent of the organizational structures of different companies. A basic way to generate such workflows has already been sketched in the course of this book (see Sects. 3 and 4.3). If in the selection phase an APS vendor is tested which offers such a workflow for the company's type of supply chain, it has to be reviewed how the organizational model had to be adapted to the pre-configured data flows of the workflow. In case the gap between the originally desired organizational model and the *"workflow model"* (resulting from this adaptation) is limited, the existence of a time- and cost-saving workflow is an indication to select the respective APS vendor.

The expenditures in cost and time forbid to implement the complete workflow model physically during the selection phase and to test the complete planning system by means of a prototype. However, some presumably critical planning modules can usually be implemented as prototypes, either by the company itself or by the APS providers. This is necessary in order to check whether a software module is capable of representing all functional requirements appropriately and to test whether high quality solutions can be achieved within an acceptable time frame. In case of failures, both the "modeling gap" and the "solution gap" constitute the functional gap introduced in Sect. 17.1.2. In order to identify the modeling gap of a software module, a small and easily solvable *"mini-prototype"* of the corresponding planning module should be implemented whose structure shows all (presumably) critical features of the desired final application. If some of the requested features cannot satisfactorily be represented, it has to be decided whether an adapted model would also be acceptable. It should be mentioned that the willingness of an APS vendor to introduce a missing function in a new software release is typically very limited (see Chap. 16).

Solely after the basic structure of the mini-prototype has been verified, the model should be scaled to a realistic, i.e. practically relevant, problem size which may reveal potential solution gaps. If a solution gap exists, a re-modeling, e.g. by using general principles of hierarchical planning like aggregation and decomposition (see Sects. 4.1 and 8.2), may be helpful. In the best case, the *"maxi-prototype"* that results after scaling and re-modeling increases the solution time and/or decreases the solution quality only slightly. In the worst case, it has to be recognized that the real-world planning problem cannot satisfactorily be solved by the software module tested. As Chap. 30 shows, this can happen e.g. by increasing the number of integer variables of a Mixed Integer Programming problem. In order to limit an investment in the wrong software, a careful test of the solution capabilities is already important in the selection phase, *before* buying a software module.

The maxi-prototypes of critical software modules help to estimate the risks and costs of an implementation of the short-listed APS. At the end of the selection phase, it has to be decided whether an APS should finally be used, which APS should be chosen and which software modules should be employed to support the various planning tasks. The following *implementation phase* can also be subdivided into three modeling steps.

If a planning and software module can be used for similar purposes at several sites, in order to save implementation time and costs, it may be useful to create a standard *template* that can be used as a basis for the implementation at all of these sites. This template has to subsume as many common features of the various sites as possible.

As a next step the templates are installed at the various sites. At each site, *workable solutions* are created on a development and quality assurance system that are used to prepare and test the finally aspired operational solutions. In order to build the workable solutions, the templates have to be adapted to the particular requirements of the respective sites. There is a general trade off to be balanced regarding the use of a template. On the one hand, using a template saves time and money of installation. On the other hand, a workable solution resulting from adapting a template usually differs from a solution that would be tailor-made for a respective site. Thus, for each site it has to be decided whether the savings gained by a template are worth the compromises that have to be made in the operational use later on.

Finally, the APS has to be connected with the (in most applications) already running ERP system or with other OLTP systems (see Sect. 13.2). If the testing has been done thoroughly, the workable solution can be transferred directly to the operationally used online system. However, if undesirable surprises occur like an abnormal behavior because of missing or obsolete data or an (despite of all tests) insufficient scalability of hard- and software, the *final solution* has to be adapted to such new requirements. During the regular use, a continuous monitoring and controlling of KPIs (see Sect. 2.3) is necessary in order to evaluate whether the planning system finally installed yields the desired effects.

The sequence of the three major phases "evaluation", "selection" and "introduction" is pre-determined by the decisions to be taken. The proposed sequence of models within a major phase is a proven but certainly not the only useful one. Of course, some of the individual modeling steps can also be combined into a more comprehensive overall model.

It should be noted that modeling skills remain important even after the final solution has been installed successfully. They are, for example, needed when a new product is to be launched or when a new technology has to be introduced that fundamentally changes the underlying planning requirements. Thus, it has to be checked regularly, whether the currently applied models of the supply chain and the currently applied planning models are still up to date or have to be re-formulated.

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