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# Technical Report

# Management by Objectives- Based Groupware:

## Requirements for Efficient and Effective Achiemevements of Objectivies

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**Abstract**. This paper is concerned with the challenges arising from the development of a groupware requirement specification for effective and efficient achievement of operative and strategic objectives in mass production industry. To analyze the process by which objectives are achieved, a systematical investigation using document analysis, participant observation, interviews and context scenario analysis was undertaken at a large manufacturing location with over 6 000 coworkers of a multinational automobile supplying company. The results of this in-depth analysis of objective achievement were utilized to develop a detailed requirement specification for a management by objectives groupware for use in mass production industry.
**Keywords**. Cooperation, CSCW, Management by Objectives

## 1  Introduction

Leading with targets, better known as "Management by Objectives" (Drucker, 1954), is the top approach used in decentralized commercial enterprises to systematically control the individual organizations (Malik, 2009, p. 174). Multiple empirical studies have already proven that the setting of goals positively affects work performance (Locke, Shaw, Saari, Latham, 1981). Nevertheless, practical experience shows that the setting of objectives itself does not necessarily lead to the achievement of the desired objectives and as a consequence the desired business results. This disparity may be due to the reasons that the achievement of objectives is a time-, work-, and resource-intense process for all responsible persons (Malik 2009, p. 174ff). Two circumstances are regularly associated with the achievement of objectives. Firstly, a status report analyzing the current state of goal achievement trough performance indicators that compare the as-is status with the to-be status (desired result) and secondly, the entire process to reach a defined goal. This process starts after an objective is determined and

can be divided into 4 simplified phases (1.) definition of measures, including due date and the person responsible, (2.) implementation of measures, (3.) performance measurement of the measures and (4.) determination of the effectiveness and achievement of objectives. Effective achievement of objectives thereby requires the definition of measures that are favorable for the achievement of objectives, while the efficient achievement of objectives entails that these measures are implemented with minimum input of time and money.

Communication and information technology in general and Computer Supported Cooperative Work (CSCW) in particular have already shown its ability to increase effectiveness and efficiency of work processes. CSCW is thereby concerned with the technical support of group work (Gross and Traunmueller, 1996,). The goal is to develop better technical support for group work by the analysis of working conditions and job requirements. Unlike traditional software (which is seen as being truly functional as soon as it runs technically error-free), a CSCW application (further addressed as GROUPWARE) is only truly functional if it also is compatible with the working conditions of the group of users (Beaudouin-Lafon, 1999, p. xii). This is an important difference compared to the development of software, as the development of groupware has do be adapted to what is technically feasible as well as to the context of the group of users and its use context. The strength of CSCW stems from an interdisciplinary research approach that allows the visualization of different strategic, organizational and technical components of a process as a holistic, computer-supported group task. By this it combines findings from computer science, sociology, psychology and economic science in order to develop new, more effective and more efficient tools and methods for the accomplishment of group tasks.

The following chapters will present the collection and analysis (including user participation) of use contexts and their context scenarios (operative processes) as well as the requirement specifications for the developers of groupware to improve the achievement of group objectives.


## 2 Methods

The focus of this study was to acquire deeper knowledge of social structures and processes in mass production industry in context of the implementation of strategic and operative objectives. This was reached by the qualitative research methods observation, questioning/interview as well as by the analysis of documents and process-generated data.

As study object a large manufacturing site (6 000 coworkers) in Jihlava (Czech Republic) of a multinational company (Bosch, 300 000 coworkers) was available. A manufacturing site is particularly well suitable for the present analysis as it has to fulfill the whole policy deployment process (from enterprise vision to operational manufacturing processes and individual tasks) in the context of the achievement of objectives. Due to the high degree of standardization within the organization and of its processes as well as the standardized software packages implemented in the mass production industry the findings are transferable also to other locations. This was examined by later interviews with employees from other locations and confirmed by

prototypic location-spreading implementation of the groupware. The researcher accomplished the observations, interviews, document and data analyses during his activity as an assistant of the plant management of the examined site during a three-year period. To assess the current state, 54 standardized interviews were conducted with responsible persons from all hierarchical levels (4x top management, 10x enabler group, 40x implementation group). Additional 5 standardized interviews were conducted for the analysis of the context scenarios. Furthermore the researcher had in the context of the document analysis entrance to all internal documents and databases as well as process-generated data from the IT-department.

# 3 Analysis of the Use Context

According to Rosson and Carroll (2002, p. 16ff) the use context of a product is determined by the users, their tasks of work, the relevant media as well as the physical, organizational and socio-technological environment. To objectively specify the use context, individual user groups were identified and the present state assessed according to Jokela (2002, p. 28). The data obtained were used to first define and then evaluate appropriate use context scenarios. These results formed the basis for the development of the requirements specification from the user's viewpoint (DATe, 2009, p. 20).

## 3.1 User Groups and their Characteristics

At the time of identification of user groups the selected production site had over 6 000 employees. Of these, 2 743 employees had access to a computer and were hence selected as potential users of the groupware in accordance with the plant management. For further characterization, users were classified into three groups according to their work organization class (cf. Table I):

| Group | Work organization class | Users per group |
|---|---|---|
| Steering group | Plant and operations managers | 12 |
| Enabler group | Department heads | 50 |
| Implementation group | Masters, group and team leaders, employees | 2 681 |

Table I. Work Organization Classification

### 3.1.1 Work Objectives and Work Equipment and Current User-Software

Work objectives to be completed and labor resources available for the achievement of objectives were determined for each users group by analyzing work profiles and standardized equipment lists and by conducting interviews (cf. Table II). The following table gives a summary of work tasks for each user group:

| Group | Work Objectives |
|---|---|
| Steering group | Defining main objectives, establishing an operation framework for the achievement of objectives at the aggregate level and supporting work through the setting and control of key performance indicators. |
| Enabler group | Deriving from main objectives sub-objectives and measures for operational implementation. Delegating and controlling the implementation and sub-goals. Supporting and tracking achievement of objectives at implementation level. Communicating goal achievement. |
| Implementation group | Implementation of objectives and measures - alone or in a team, documentation and communication of achievements to the enablers and steering group. |

Table II. Work Objectives of User Groups.

Due to standardization the following equipment was available to all user groups: office workplace (desk, chair and office cubicle), a computer with standard software (Microsoft Windows and MS Office) and access to inter- and intranet, printers and scanners. Projectors and white boards (with from board printer function) were available in the office or shared meeting rooms.

SAP and Hyperion are introduced group-wide. This allows monitoring, documentation and visualization of the most important top-level business figures from the group´s perspective. For operational processes of goal achievement regularly no standard software and no template (e.g. for Excel) was defined. Exceptions were made for pre-defined work processes where all steps of goal achievement could be precisely defined in advance (e.g., customer complaint process with an Excel checklist). Details of the goal achievement were communicated by e-mail, orally (e.g. meetings) and trough department notice boards by current printouts. Key figures for the analysis of goal achievement were primarily indicators for measuring the results. These indicators were located, depending on the objectives and responsible persons, on local Excel, Word, Access files, Oracle, SAP and other IT solutions and even in paper lists. Access to this information was therefor frequently not possible for all members of the target groups. Visualisation, in order to recognise the goal achievement faster was not implemented by default and was implemented afterwards by additional work. A following up of measures to achieve goals was also found regularly in locally maintained OPL's (Open points list), to-do lists, Mile Stone plans, project solution sheets and other free-form MS Office documents. For asynchronous communication, the e-mail program Microsoft Outlook has been used. Shared network drives offered the ability to view and edit documents together (asynchronous). Furthermore some users used NetMeeting and Interwise in telephone conferences as groupware for synchronous shared use of screen surfaces.

3.1.2  Physical and Work Organizational Environment

In order to evaluate how much time users had available to work at their computer, data on office time and computer working time were collected using on-site observation and interviews (cf. Table III).

| Group | Physical and work organizational environment |
|---|---|
| Steering group | Office time is very limited (30-50% of working time). People are on business trips (domestic and foreign) and at meetings in other departments and production areas on a regular basis. |
| Enabler group | Office time is limited (40-80% of working time). People are on business trips (domestic and foreign) and at meetings on a regular basis. |
| Implementation group | Office working hours for white collar employees and team leaders comprise 75-100%, for group leaders 40-80% and foremen 30-40% of total working time. |

Table III. Physical and Work Organizational Environment.

### 3.1.3 Technical Competence of the Users

Information on this aspect was collected on spot by interviewing the prospective user. Goal was to determine what technical components could be used in the collaboration system so that users may work with the features of the groupware applicable to them quickly and intuitively and without further training.

Users worked reliable (edit, create, format and save documents) with standard software (Microsoft Excel, Word, PowerPoint, Internet Explorer, documents and folder management). Deep knowledge of Excel (use of complex formulas, pivot and conditional formatting, hyperlinks) was not routinely available (steering group 10% of users, enabler group and implementation group 20% of users. Know how for working with databases and special data processing software was only available on a very limited basis and only to fulfill special predefined tasks (e.g. e-Works purchase orders, approval processes).

## 3.2 As-is Work Support for the Achievement of Objectives

Objective of this as-is analysis was to obtain an overview of the as-is execution of currently running projects and work processes. The instruments applied were document analysis, interviews with representatives of the user organization and analysis of the current software used. The results of the as-is analysis formed the basis for establishing context scenarios and developing use concepts for a groupware from the perspective of the user.

### 3.2.1 Process Flow and Quality Criteria for the Achievement of Objectives

As the quality management system (ISO certification) and process standardization provided valid and documented instructions, document analysis was carried out to determine the to-be process flow and determine quality criteria for the achievement of objectives. Materials available included flyers, leaflets, illustrations, multi-page brochures, management manuals, internal research reports, online information platforms, internal company documents from online collaboration rooms, and corporate intranet sites. As an example the English translation of a passage taken from the brochure "Zielentfaltung bei Bosch" (in English: Policy Deployment at Bosch") is given below:

The main task in target implementation is to plan and organize activities. Thereby is to decide in which way and by which means the achievement of objectives is sought. Consistent action is imperative for the successful achievement of objectives. Thereby is important that the employees get transferred both the responsibility for the achieving the objectives as well as the necessary decision freedoms (Keywords: delegation, empowerment).

Based on this document analysis a theoretical to-be flow of the goal achievement process was mapped from the company's perspective. Goal achievement is seen as part of an 11-step policy deployment process. As soon as the process of goal determination for the principal objectives is completed, the process of achieving the objectives begins. The goal achievement process itself is thereby divided into the sub-processes objective processing, target tracking, visualization and management review. A generally valid and standardized process flow for the systematic implementation of operational objectives, objective processing, target tracking, visualization and management review was not specified. Furthermore, as part of the document analysis, quality criteria for evaluating the quality of objective processing, target tracking, visualization and management review were established.

1. (Sub-) goals are ambitious.
2. The goal is formulated understandable, influenced, accessible, and provide motivation for the employees.
3. Objectives are measurable and relevant referred on the overall objectives.
4. Objective achievement and monitoring is done consistently, by systematically comparing as-is status and to-be status of achievement of objective and by taking appropriate measures to achieve the desired to-be value.
5. Relevant information and data for communication and performance monitoring of the organizational unit are displayed in well accessible location within the organizational unit visually appealing and timely.
6. Managers regularly seek information on the status and progress of goal achievement.
7. If agreed targets due to serious changes are not objectively achievable, goal adjustments are made.

### 3.2.2 Current user requirements

To accommodate the needs of different users for an objective achievement groupware, based on a standardized interview guide interviews were held. There were a total of 54 interviews conducted (4x from steering group, enabler group 10x, 40x implementation group). Hereinafter the user requirements for a groupware were summarized for each group.

Steering group: (1.) Clear presentation of goal achievement, visualization at a glance, (2.) standardized and up-to-date representation of goal achievement of the main objectives, (3.) drill down option: Ability to access sub-goal data, measures and responsibilities, (4.) easy access to the goal achievement information (5.) regulated access to confidential information, (6.) "Nothing new" in terms of software, hardware, methods and (7.) no additional costs for hardware and software.

Enabler group: (1.) Uniform standard systematic for deduction of sub-goals from main goals, distribution of responsibilities, objectives and goal achievement, documentation of responsibilities, objectives and achievement of objectives, (2.)

communication of responsibilities, objectives and achievement of objectives and (3.) reduction of reporting effort.

Implementation group: (1.) Reducing the administrative burdens for documentation, communications and preparation of reports and (2.) usage of already known software.

## 3.3 Survey and Analysis of Context Scenarios of Achievement of Objectives

The analysis of context scenarios for the achievement of objectives helps to understand needs in the use context of these group tasks and by this to derive requirements for the groupware. In order to meet the different facets of achievement of objectives, these five, in terms of tasks, activities and context entirely different context scenarios were selected:
1. Achievement of day to day business objectives by the example of quality control and quality improvement of suppliers
2. Achievement of globally distributed objectives by the example a rationalization project in the international production network
3. Achievement of objectives for implementation projects by the example of the EFQM implementation
4. Achievement of headquarter objectives by the example of employee qualification project
5. Achievement of strategic objectives by the example of the policy deployment process.
6. After the context scenarios were recorded and analyzed, the requirements specification to create a groupware was made. This is described in the next chapter.

# 4 Requirement Specification

The requirement specification identifies objectives, usage, operating conditions, features, data, and performance and quality criteria of a given groupware.

## 4.1 Groupware Objective

In both the as-is analysis and the context scenario interviews, potential users reported that communication and coordination required a high amount of work, especially with relevance to understanding, discussing, working out the details of, and accurately setting goals, sub-goals and expected results (cause-effect chains). Equally high amounts of work were also required for the reporting of achievement of objectives. From the standpoint of the process participants, groupware should therefore aim at reducing the amount of work required for communication, coordination and reporting, or, preferably, to automate and simplify some of these activities.

## 4.2 Groupware Features

The different product features required of a groupware were derived from the analysis of context scenarios and hence can be used as a basis to develop mandatory technical specifications.

Functionality for standard user

The standard user can use the groupware as soon as he obtains the appropriate user rights from the groupware administrator (see administrator functions).

The standard function consists of:

- F10 Documentation of plan, measures, as-is status and responsible individuals to accomplish a specific objective or sub-objective
- F20 Automatic graphical presentation of performance indicators for achievement of objectives (includes historical values, benchmarks, plans and forecasts in relation to as-is status)
- F30 Automatic transfer and calculation of objectives achievement level from other data sources
- F40 Creation of links to other data sources
- F50 Standardized input function for nonstop documentation of achievement of objectives (see general input functions)

Input functions for the achievement of objectives are:

(* indicates support of automated input trough other data sources)

- EF010 entering the objective (name)
- EF020 input of person in charge for main objective (name and department)
- EF030 input of document owner (name and department)
- EF040 input of objective description
- EF050 entering the date of the last update of the document
- EF060 input of last year's degree of objectives achievement
- EF070 input of plan value (BP) for this year´s degree of objective achievement (BP= business plan)
- EF080 input of the as-is status for objective achievement (YTD = Year to Date) *
- EF090 input of current forecast for objective achievement (CF = Current Forecast) *
- EF100 inputs of traffic light coding for the objective achievement (green, yellow, red)
- EF110 input of sub-goals of operative measures to achieve objectives
- EF120 input of responsible for measures or sub-goals to achieve objectives (acronym)
- EF130 input of measuring unit for achievement of objectives (number)
- EF140 input of planned values for the achievement of sub-objectives (BP)
- EF150 input of as-is sub-goal-achievement degree (YTD)
- EF160 input of forecasted degree of sub-goal achievement (CF) *
- EF170 input of degree of achievement of objectives of past four years
- EF180 input of plan values of past four years
- EF190 input of benchmarking values of past four years

- EF200 input of cycles (e.g. monthly) for the intermediate measure of achievement of objectives degree
- EF210 input of planned intermediate achievement of objectives degree
- EF220 input of actual intermediate achievement of objectives degree
- EF230 input of forecasted intermediate achievement of objectives degree
- EF240 input symbols for the planned start of measures (white triangle with the top up)
- EF250 input symbols for executed start of measures (black triangle with the top up)
- EF260 input symbols for planned end of measures (white triangle with the top down)
- EF270 input symbols for executed end of measures (black triangle with the top down)
- EF280 input symbols for planned milestone (white star)
- EF290 input symbols for reached milestone (black star)
- EF300 input of the due date calendar day for measures and sub-goals to be performed
- EF310 input of traffic light coding for objective achievement degree of measures and sub-goals (green, yellow, red) *

Functionality for administrator

System Administration:
- AF10 Network administration for the intranet and network drives
- AF20 Ensure backup function for the data on the network drive

Groupware Administration:
- AF30 Securing access for work environment through pre-defined allocation of access rights for specific user groups or through individual allocation of access rights to specific users
- AF40 Management of folders and document structure
- AF50 Metadata definition and input
- EF320 K-Nr. (only Administrator)
- EF330 Strategic ordinal number (only Administrator)
- EF330 Hierarchical ordinal number (only Administrator)
- EF340 Top and bottom-line Input (only Administrator)
- AF60 User contact person for technical and textual questions about groupware usage

## 4.3 Groupware Data

Persistent groupware data:
- Objective (name)
- Responsible for overall objective (name and department)
- Document responsible (name and department)
- Objective description
- Manually inputted date for the last update of document
- Last year's degree of objectives achievement

- Plan value for the degree of this year's objectives achievement (BP = Business Plan)
- Actual degree of achievement of objectives (YTD = Year to Date)
- Forecasted achievement of objectives degree (CF = Current Forecast)
- Traffic light coding for the objective achievement degree (green, yellow, red)
- Measures or sub-goals to achieve objectives
- In charge for measures or sub-goals to achieve objectives (department acronym)
- Measurement units for achievement of objectives (code, e.g. Euro)
- Plan value for sub-goals achievement of objectives (BP)
- Actual degree of achievement of objectives (YTD)
- Forecast of achievement of objectives degree (CF)
- Degree of achievement of objectives of past four years
- Planed values of last four years
- Benchmarking values of the past four years
- Cycles for the intermediate outcome measures of degree of objectives achievement
- Planned intermediate values of objectives achievement
- Actual interim results of objectives achievement
- Intermediate results of forecasted degree of achievement of objectives
- Position of the symbols for planed start in the time frame
- Position of the symbols for executed start in the time frame
- Position of the symbols in the time frame for planned end
- Position of the symbols in the time frame for the executed end
- Position of the symbols in the time frame for the planned milestone
- Position of the symbols in the time frame for the reached milestone
- Due day calendar date of measures and sub-goals in the time frame
- Traffic light coding for objective achievement of measures and sub-goals (green, yellow, red)

Groupware metadata:
- K-Nr.
- Strategic ordinal number
- Hierarchical ordinal number
- Top- and bottom-line data
- Last Saved By: (User ID)
- Last saved on: (date)

## 4.4  Groupware Usage

In order to implement one standardized process for communication, coordination and reporting of achievement of objectives within an organization, the groupware developed should be applicable to both commercial and engineering objectives as well as sub-objectives. This will ultimately reduce the workload required for report customization, performance indicator conversation and discussions and coordination within the group.

Groupware scope: Depending on the objectives the groupware shall be able to support persons, teams, departments and sites on a local level, as well as whole production networks, distributing sites and teams on a global level in their achievement

of objectives. The external use (e.g. objectives to be pursued together with a customer or supplier) is not intended but can be integrated if required.

Groupware target group: The groupware target group comprises all people within the organization involved in the process of objective achievement with access to a computer and the local area network (NT user ID).

## 4.5   Groupware operating conditions

The groupware shall be designed to run using the standard computer and network configurations, without requiring additional software, hardware, databases, administration, licenses and special training for groupware users. To fulfill these conditions the groupware was designed to run within the following framework:

1. Software: Operating system Windows 2000 and above, Microsoft Excel spreadsheet program, SAP Business Warehouse Client (optional)
2. Hardware: Computer hardware that can handle the defined software requirements and that can be attached to a network
3. Orgware: Network with network hard drives, backup software for documents on the network hard drive, SAP Business Warehouse

## 4.6   Groupware Performance

The product features should implicitly support the following demands:

1. Support employees in thinking and acting in feedback loops.
2. Support employees' understanding of cause-effect chains and relationships between objectives.
3. Support employees' understanding of process interdependencies across departments.
4. Support employees in implementing a new objective achievement process quickly, fast and flexibly but in a systematical fashion.
5. Support employees in ensuring the transparency of individual responsibilities within a measurement package with many responsibilities.
6. Support employees in presenting the visualization of planned/achieved milestones, start and end times.
7. Support employees in easily presenting a monthly graph of the performance changes in quantitative measurement of the achievement of objectives.
8. Support employees in integrating data from external data sources (in particular regularly manually updated spreadsheets with figures) in their reporting and avoiding duplication of efforts.
9. Support employees in automated updating of data in the reporting system.
10. Support employees in presenting and visualizing the reporting for senior management in a transparent and clear form (performance monitoring).
11. Support employees in creating a link to directly related objectives and to systematically track the objective achievement process throughout the cause-effect chain on the computer.

12. Support employees with a drill down function from the main objective to sub-objectives and to the operational activities (measures), including the relevant data for each main and sub-goal.

## 4.7 Implementation

The groupware was technically realized to run on the standard computer configuration and in coordination with the IT department of the organization. In addition to the development of a prototype, the main goal of this research was to determine whether and how a standardized achievement of objectives process with standardized rules and procedures would make the achievement of objectives more efficient and more effective.

# 5 Conclusion

The keys to success in the context of the achievement of objectives are determined by the human input. A groupware that supports groups to make documentation of required data easier, less time consuming and fail-safe, and, at the same time, functions as an information platform for the whole organization is helpful. In this capacity it provides necessary data such as measures, responsibilities, time tables and performance indicators in a transparent, standardized and understandable form and so reduces the reporting effort. Furthermore, a groupware has to fulfill its functions without being too technically and operationally demanding. The requirements of a groupware determined within this study may therefore form the basis for the development of a groupware, specifically tailored to the needs of an achievement by objectives-run organization in mass production industry.

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