Chapter 2
Breakdown of Project Objective

2.1 Basic Objective Structure

Any project objective usually is composed of various subobjectives that can have different and varying weights. In order to subject a project as a whole to a comparison, its objectives have to be structured in a clear and consistent way, independent of the work breakdown structure [29].

Figure 2.1 shows a basic and very simple objective structure that we want to call the Basic Objective Structure, in distinction to other objective structures.
Fig. 2.1 Basic Objective Structure
The Basic Objective Structure starts from the DIN (Deutsches Institut für Normung, German Standardizing Institute) definition for a project objective as “result to be achieved and realization conditions of the overall project task” [84]. In a first step, this project objective is being subdivided according to Fig. 2.2.

Combining low-level subobjectives, we get the respective high-level (sub)objectives. These three highest levels of the Basic Objective Structure can be applied to many types of projects; so evaluations can be made between projects from different branches.

More levels, as a whole or in parts, can be added to the structure shown in Fig. 2.2, if necessary. Figure 2.3 shows an example of an expansion with parts of a level.

Naturally, added levels will be designed according to the needs of a specific user and thus be less portable to other types of projects. Apart from a greater amount of work, there are no disadvantages connected with an expansion; on the contrary, it leads to a better founded project evaluation later on.

Significant names may be given to all added subobjectives. Breakdown into goals and goal weights will take place in the same way as with the Basic Objective Structure.

2.2 Expanded and Reduced Objective Structures

More levels, as a whole or in parts, can be added to the structure shown in Fig. 2.2, if necessary. Figure 2.3 shows an example of an expansion with parts of a level.

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Significant names may be given to all added subobjectives. Breakdown into goals and goal weights will take place in the same way as with the Basic Objective Structure.
On the other hand, the objective structure can be reduced, too. With information technology projects, for example, in an early stage only the amount of person-hours or person-months will be taken into account instead of separately comparing cost objective and time objective. Time and person requirements can then be derived using prior experiences, and costs will be calculated according to hourly wage rates.

As we have seen, the Basic Objective Structure is not a condition to be fulfilled, but only a generally useful structure model for project comparisons. We will consistently be using the Basic Objective Structure for our examples in the present work.

2.3 Goals

2.3.1 Freedom of Choice

Every lowest-level subobjective in any branch of the objective structure will be subdivided further into two goals: Base-Goal and Check-Goal. The reason for choosing exactly two will be treated in the next section; first, we want to look at goals in a general sense.

Goals are criteria that can be observed in any specific project, i.e. they are given in the project definition or in plans, calculations, reports etc., describing the respective subobjective. Their values, varying between projects, reflect details of process and performance that may be compared.

Possible goals could be with

| Cost objectives: | development costs, tool costs, assembly costs, total costs of the project, life cycle costs, costs for specific project phases or key activities, the effort in person-months already mentioned, excess building costs or project costs, etc. |
| Time objectives: | development duration, phase duration, project duration, periods between milestones, key activity duration, delay of acceptance deadlines, delivery delay, discrepancy between planned and actual repair times, etc. |
| Object objectives: | economic efficiency of the object after completion (e.g., operating costs for singular products, production costs for series production), maintenance effort, insurance effort, evaluation marks by independent testing institutions, future demolition costs or waste management costs, etc. |
| Quality objectives: | reliability, life span, rate of waste and rectification, rejections, excess warranty costs, rate of reclamations, downtimes, etc. |

This mixed bunch of goals shows how different possible project comparisons can be. Object objectives and quality objectives often merge; this does not interfere with project comparisons as the user can decide on the classification. Suitable to serve as a goal is any attribute that
2.3 Goals

- is to be maximized or minimized in the course of the project,
- can be observed in all projects to be compared and can be expressed on a scale, and
- whose importance justifies the introduction as a subobjective.

Generally, this freedom of choice concerning goals will inhibit the transfer of a specific set of goals to other types of projects. On the other hand, this freedom makes it possible for the user to customize the comparison.

To get an overall project evaluation, goals for all four objectives (cost, time, object, quality) should be taken into account, because any project is an inseparable compound of issues concerning cost, time, and performance. Only maximum completeness of criteria for the projects to be compared will lead to a reliable overall evaluation.

An unbalanced evaluation not only will be misleading, but also have negative impact on the projects: Probably the project team members will attend with special care to the attributes chosen for evaluation, which might affect the ones not chosen.

2.3.2 Base-Goals and Check-Goals

In the preceding section, we mentioned subdividing every lowest-level subobjective into two goals. This kind of decomposition reflects the typical double requirement inherent in the running of a project.

For example, given a specific performance, on one hand the project finish date should not be exceeded, on the other hand the planned project duration should be as short as possible. However, the shorter the planned project duration, the more difficult to keep the finish date and thus the time objective.

Likewise, with a given performance, on one hand the planned project costs should not be exceeded, on the other hand they should be low. The lower the planned project costs, however, the more difficult their keeping and thus the cost objective.

Similar requirements, though not always that obvious, arise for other subobjectives. Therefore, both sides of the double requirement always have to be observed.

To help the reader understand this issue better, a short example for a time objective is about to follow. Simultaneous observation of the respective cost objective will be cut out for the sake of more clearness.

Let us imagine that two project managers A and B, not knowing about each other, might independently be given the same performance objective (performance objective meant in the sense of Figs. 2.1 and 2.2). Project manager A demands 10 months’ time to achieve his performance objective, project manager B demands 12 months. Both get identical tasks, observing these different conditions.

Later on, we might check the results: Project manager A took 11 months to achieve the performance objective, whereas B took 12 months and one week. Project manager A had set for himself a more difficult task than project manager B, but he
achieved his aim less accurately than B; nevertheless, A had been the faster one. Which one has shown better time handling?

Presenting different people with this question, probably we will get different answers. Maybe, we ourselves are not immediately sure about which result is to be held the better one.

A systematic way to answer our question opens up with the insight that any time objective consists of two different goals, i.e. the double requirement mentioned above. Looking separately at the goals “time needed” and “discrepancy to time agreed”, we can simplify our reasoning.

This reasoning cannot end up simply in a discrepancy/time ratio; this ratio would only be another discrepancy value, as here the actual time needed would not be visible any more. Rather, we have to think about our interest in the time needed and in the discrepancy in time.

At this point, we want to leave our example for the time being to make a transfer of our insight, attained for the time objective, to the other subobjectives. So, in order to get a well-founded project evaluation, we have to find goals to model the double requirement, which exists for every subobjective. Thus for every lowest-level subobjective we have to choose a Base-Goal and a Check-Goal in such a way that

- Base-Goal values (the time needed in our example) show how difficult it is or was to attain the subobjective,
- Check-Goal values (the time discrepancy in our example) show how well the Base-Goal values are or were kept (Fig. 2.4).

![Fig. 2.4 Symbolic decomposition of lowest-level subobjectives](image)

Usually the terms Difficulty and Keeping can be easily joined to the designations of the subobjective, e.g. Cost Difficulty and Cost Keeping. Cost Difficulty means “Difficulty of the cost objective”, Cost Keeping means “Keeping of the cost objective”. The same holds for other subobjectives. In this text, we will use capital letters wherever this special meaning of the words “keeping” and “difficulty” is needed.

Figure 2.5 shows an example, Keeping here is being represented by the discrepancy between final and initial values.

Instead of the discrepancy between final and initial values, other endogenous goals could serve as Check-Goals, e.g., the characteristics “Termintreue” and “Kostentreue” (degree of continuous adherence to schedule and budget, respectively) [91] or corresponding actual/planned value ratios.
2.4 Goal Weights

Comparing projects, we also have to take into account the weight individual goals are bearing for a specific project. With some projects, it is most important to complete the project rapidly, with others to exactly keep the planned finish date, the budget, the object quality, or any other goal.

This varying importance of goals can be implemented into project comparisons by choosing goal weights. To every goal, a corresponding goal weight will be attributed.

In this way, every lowest-level subobjective now consists of four elements: one pair of goals and the corresponding pair of goal weights. Figure 2.6 shows this

Fig. 2.6 Goals and goal weights of lowest-level subobjectives

The term “Difficulty” describes only part of the degree of difficulty of a project, i.e., the one represented by goals. Other aspects of the degree of difficulty can be taken into account differently, as we will see later on. Moreover, the terms Difficulty and Keeping will also be defined mathematically and become important characteristics.

Pairing off Base-Goals and Check-Goals not only serves to complete and systematize project evaluation, but again to neutralize inevitable impact of the evaluation on other projects. Any incomplete evaluation may interfere with subsequent projects.

For example, considering only the keeping of the time objective would favor making allowances for excess time in the plans and thus increase the planned duration. Evaluating duration only, on the other hand, might endanger the keeping of subsequent time objectives.
expansion on Fig. 2.4. Weighting the goals naturally results in weighting all the lowest-level subobjectives relatively to each other.

You may wonder why we have separate goal weights for Difficulty and Keeping, respectively, of the same subobjective. The following time objective examples may help to understand this:

It could take ten years to develop a new medicament. Readiness for marketing should be reached as soon as possible (i.e., high goal weight of Time Difficulty), but the exact day does not really matter, even if, quite understandably, a specific date will be planned (i.e., low goal weight of Time Keeping).

An Olympic Games realization also may be thought about for ten years before the event. Depending on the necessary investment volume, there may be ample time (i.e., low goal weight of Time Difficulty), but delaying the beginning of the event is nearly impossible to imagine (i.e., high goal weight of Time Keeping).

Figure 2.7 is showing the theoretical structure of these two examples. Simply attributing an overall weight to the time objective would fail to take into account the different project conditions, i.e. the double requirement for project realization. The same goes for all the other subobjectives of any project.

![Lowest-Level Time Objective](image)

Now we can finally answer the question we mentioned in Sect. 2.3.2. There we wanted to know which one of the project managers A and B had shown better time management. The answer is “That depends on the goal weights”.

This is not an evasive response, but perfectly correct. Once we have indications as to the goal weights of our example there can be shown whose time management was the better one. We will explain how this can be calculated in Sect. 5.2, and we will extend the method to all goals.

Goal weights, on the other hand, not only help evaluate finished projects but also are strategic specifications for running the project. They should be documented in the project definition, although they can change during the process.

When defining the project objectives, weights of goals – or at least their ranking – will be discussed anyway, because knowing them is necessary for objective-oriented planning and managing of the project. Numeric indication of goal weights does not complicate matters, the more so as comparing projects during an early stage is particularly profitable.

The weight scale should be easy to handle; I would recommend integer values between 1 and around 20. During the test phase for introducing project comparisons, goal weights usually will have to be estimated retrospectively.
2.5 Forms and Values of Goals and Goal Weights

Every goal and every goal weight will appear in varying types or manifestations for the projects being compared, e.g. as an initial or planned value, as a final or actual value, or as an intermediate value. Later on, we will deal with mathematically transformed values as well as with values that have been corrected using inflation indices.

For the sake of shortness, we will call these different manifestations the “forms” of a goal or a goal weight. We will talk about the collected form, of index corrected and of transformed forms of a goal; generally, we will refer to goal forms, meaning the different well-defined goal manifestations.

In the same sense, we will talk about values as project values, as index corrected or transformed values of the goal etc. Project values are those that are observed directly on the project itself – or, coming from other sources, are equivalent to such observations – and that will be collected in an appropriate file for the use in project comparisons; for example, the collected forms of data consist of project values.

In this publication, we will assume only initial and final values. For project duration, e.g., we will call those two values initial project duration and final project duration, as well as for project costs, initial project costs and final project costs, respectively. Only for one non-parametric example (Sect. 13.5), we will make use of intermediate values for project comparisons.
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