Thinking future with Risk Management – a substantial tool of Life Cycle Management

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ABSTRACT: Risk Management is a substantial tool of Life Cycle Management. Risk Management meets the demands and copes with the challenges of Life Cycle Management by means of suitable models, methods and responses. In order to cover an overall perspective for the statements, Risk Management simultaneously uses Opportunity Management. It works at all levels from objectives to operative implementation of building projects and integrates the results into all levels in turn. In order to achieve an application quality as high as possible, there is a need for a thorough awareness of risk philosophy and a high understanding for influences, ability to influence, sensitivity, quality of information (statements), dynamics and strategic range of the results. Risk Management requires practical experience, a sense of visions and the courage to assess the future.

1 INTRODUCTION

Buildings influence the environment und build the future. Nowadays Life Cycle Management means not only to define the best technical durability. It goes further and tries to find the optimized building in the fields of efficiency, technical quality, maintenance, impact on the environment, comfort for the user and of course economic performance. To achieve all these aims it is essential to have the right management tools to integrate the different demands and to create future scenarios for the decision making.

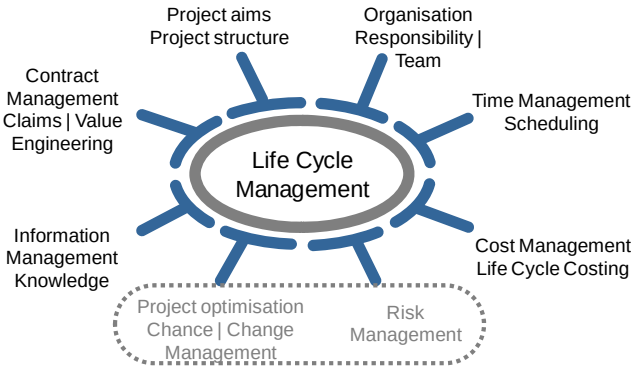

Figure 1. Tools for Life Cycle Management (Stempkowski & Waldauer 2011)

2 LIFE CYCLE MANAGEMENT

Life Cycle Management deals with shaping and optimization of objects at all stages from as early as the first project concept. Therefore the project development already involves considerations for the subsequent phases of planning, construction, of operating until converting and eventually the phases of deconstruction at the end of the object's life cycle. The predictive main idea, expressing what has to be done today in order to work optimally in the future, extends through the entire project. If the scope of actions decreases with time, there is the challenge to gather and to evaluate experiences for future projects.

Life Cycle Management uses the basic features of professional project management in regard to construction with the extended focus on the project's life cycle. This requires different adaptations, additions and expansions of existing tools.

2.1 *Project Aims and Project Structure*

The project management needs to adapt the structures to an overall perspective of the project till the end of the object's life cycle.

The project aims that are required for the development and implementation of a construction

project are extended in regard to operational goals. Here the integrated project framework gets determined, e.g. in regard to operating life, the required qualities, high flexibility for future changes of use etc. As a consequence this affects the project's orientation.

2.2 *Project Organisation*

The project organisation should consider experiences from operating at an early stage. Therefore e.g. Facility Management Consultants or Facility Planners are to be involved in order to integrate operational requirements already in the development and the entire process of planning and to promote optimizations. Integrated Design offers a solution where all relevant consultants (e.g. energy technology, building services engineering, facade planner, …) get integrated into the planning process early and in a structured way.

2.3 *Time Management*

Scheduling goes further than to the end of the building process. It also has to deal with the commissioning in a more detailed access. With that approach the object can be operated from the very beginning in an optimal technical adjusted mode.

2.4 *Cost Management*

Following the life cycle philosophy the perspective of investment costs has to be enlarged. Cost Management has to treat the total costs of an object, the life cycle costs.

2.5 *Information Management*

Information Management does not only mean documentation of the building process. Knowledge and practical experience should be preserved and used in a sustainable way, in the operating phase as well as for future project developments. This requires more than simple documentation, appropriate methods of knowledge management and information management tools should be used to meet the new demand.

2.6 *Contract Management*

In some fields traditional building contracts can be exchanged be other contract forms, such as design-build-operate-maintain (DBOM) or build-operate-transfer (BOT) or other variants. Thus the responsibility for the economic operation of a building is transferred to or shared with contractors, therefore also the functionality of the building is ensured.

Even when talking about Value Engineering the focus has to change. In most cases it aims at the reduction of investment costs. Life Cycle Management spotlights the optimization of the life cycle costs instead.

2.7 *Risk and Opportunity Management*

Risk and Opportunity Management also have to enlarge their approach to the life cycle. That means especially an adaption in structure and a widespread search of potentials of uncertain deviations in all phases of an object. Furthermore implementing Risk and Opportunity Management improve the quality of the whole Life Cycle Management.

3 RISK MANAGEMENT

3.1 *Definition of Risk*

The international standard ISO 31000: "Risk management – Principles and guidelines" defines risk as "*effect of uncertainty on objectives.*

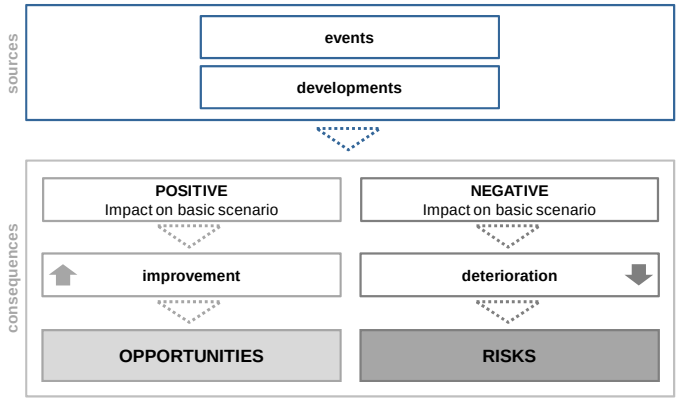

Figure 2. Definition of Risk and Opportunity (Stempkowski 2012)

An effect is a deviation from the expected — positive and/or negative.

Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Risk is often characterized by reference to potential events and consequences, or a combination of these.

Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.“

In addition ISO 31000 defines risk management as *„coordinated activities to direct and control an organization with regard to risk“*. Risk Management therefore describes an approach to eliminate uncertainties actively. If you transfer the general definition from the organizational level to the project level as commonly applied in construction, it will be regarded as support of the project during the entire development – in the sense of Life Cycle Management for the entire lifetime of a project. Reasonably enough it is used from the start of a project in order to achieve greatest possible effects. However, it also can usefully and effectively get implemented into the on-going progress.

The risks of project development and realisation are manifold and must be at least seen specific for every project. A rough guide for the risk analysis in practice is held in simple categories like

- Technical risks (planning, property dealing, foundation ground, groundwater, performance deviations, changes in quality, …)
- Legal and procedural risks (complications in the procedure execution, complexity of procedure, changes in legal basis, quality of contracts, ...)
- Environmental risks (requirements of the project environment, prevention policy of stakeholders, news coverage, ...
- Market risk (restrictions of the market, level of prices, cost increases, ...)
- Financial risk - if the financing is part of the project costs (interest rates, discontinuation of investments, ...)

In the further life cycle of a real estate there appear additional risks that impact the compliance costs. Here, the following risk groups can be distinguished.

- commissioning risks (trial run, ...)
- maintenance risks including servicing (mode, intensity, lack of servicing, ...)
- Cleaning risks (mode, type, duration, ...)
- repair and modification risks (flexible buildings, consideration of modification requirements already in the design, impairment of the use of the building during modification, ...)
- subsequent use risks (demolition, recycling, reuse, ...)
- user risks (behaviour, change, poor maintenance, ...)
- price trend (energy prices, wage rates, construction costs, ...)

3.2 *Basic Idea of Risk Management*

Risk Management works as key tool in order to consider impacts and consequences of project decisions and developments of basic conditions, finally steering the project gradually into the right direction as well as optimize and develop it.

Risk Management provides the Life Cycle Management with added value and some significance especially by creating excellent bases for decisions. Thus any uncertainties concerning short, medium and long-term future can be dealt with optimally.

Risk Management is the tool which uses scenario-based designs to create different situations considering influences and impacts on the future building and its environment in the short term as well as in the long term. Therefore it is a powerful and indispensable tool for Life Cycle Management which treats the consequences of aims and decisions at the phase of design to the built and operated object till the reuse of the object.

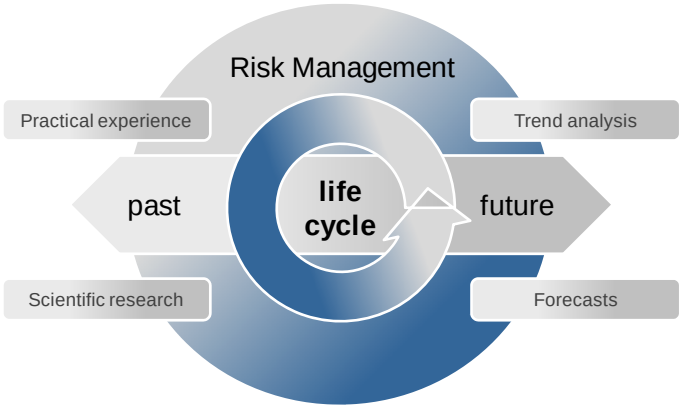

Figure 3. Perspectives of Risk Management

Risk Management integrates practical experience, scientific research and trend analysis for the forecast to build scenarios out of different perspectives. The practical experience from many projects accompanied provides the following key points.

- It is not only about finding a right figure – for example the total investment or life cycle costs,
- it identifies the main issues,
- it shows the main aspects which have to be managed,
- it specifies measures that have to be taken,
- it creates a system for dependences and sensitivity,
- it detects time risks and uncertainties of the schedules,
- it implements opportunities and optimization potentials and
- it evaluates the knowledge from other projects.

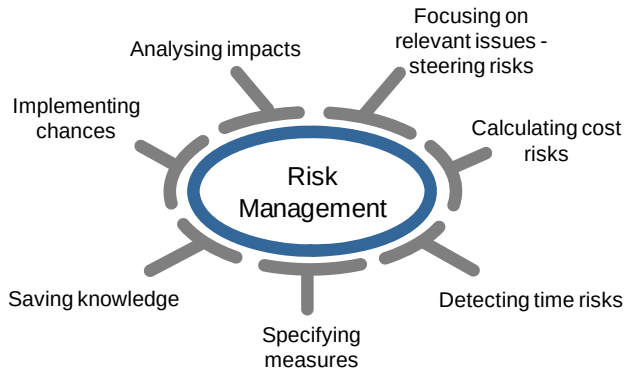

Figure 4. Elements of Risk Management (Stempkowski & Waldauer 2011)

3.3 *Process of Risk Management*

Risk Management can be applied efficiently by means of a structured process. This ensures that the results were treated comprehensively according to the same principles and are prepared comprehensibly. The developed approach in regard to the application of Risk Management is designed according to the simple management principle and matches the normative guidelines with the requirements of building projects.

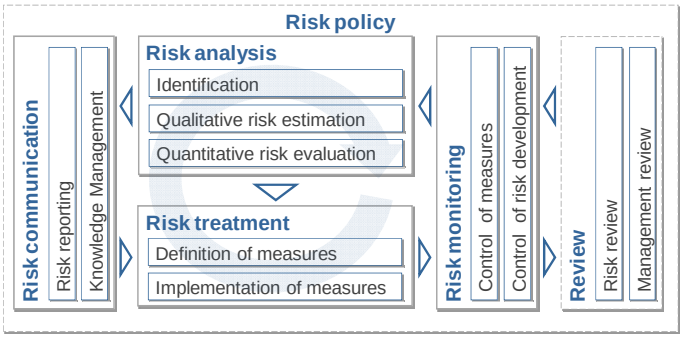

Figure 5. Risk Management Process (Stempkowski 2012)

3.3.1 *Risk policy*

At the start of each application of Risk Management, there should be a specific risk policy. This resembles a integrated approach which provides a simultaneous dealing with Risk and Opportunity Management. It defines the commitment to an active Risk Management, to methodology, quality and depth of analysis, the field of application, the responsibility and criteria for exclusion which strongly influence the company's activities or decisions concerning the project. Therefore the risk policy not only determines a style but also creates the basis for an appropriate culture that accompanies the life with Risk and Opportunity Management.

3.3.2 *Risk analysis*

On the basis of the risk policy for the project, a risk analysis is carried out which comprises the identification of risk potentials, the qualitative risk estimation and the quantitative risk evaluation. The risk analysis should identify as many potentials of deviation as possible in comparison to the defined basic scenario, e.g. current state of design or implementation of the quality definition, of costs and schedules.

The risk estimation uses a qualitative rating scheme, e.g. points system, to form a cluster of identified potentials according to their relevance. Risks and opportunities that are decisive will be further dealt with.

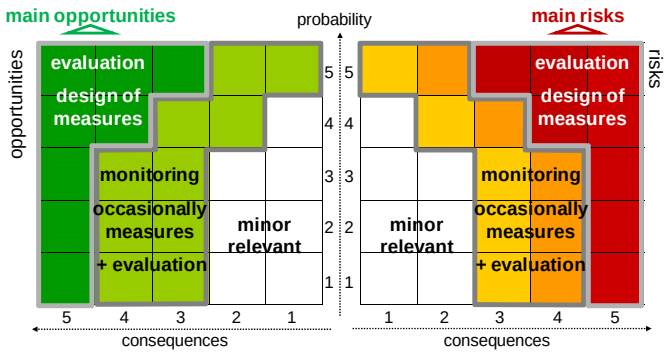

Figure 6. Risk matrix (Stempkowski 2012)

The risk matrix graphically clarifies the instructions for further procedure.

By means of the quantification of individual potentials the extent of risk and opportunity impact in dimensions of costs (e.g. risk costs in €) and time (e.g. buffer in weeks) gets identified and an overall level of risk for the project can be established. Results derived from the evaluation are transferred to the corresponding tools of Cost and Time Management.

3.3.3 *Risk treatment*

Any relevant risks and opportunities are a matter of priority in regard to Risk Management. During risk treatment a risk strategy for efficient and effective dealing with risks or optimization of opportunities gets designed and implanted. In order to do this, suitable measures are defined and compiled in a coordinated plan of measures.

Risk treatment always aims at avoiding risks or at least reducing them. However, the effort for the necessary measures must not exceed the extent of risk reduction. Responsibility for the risk treatment should always be taken there where one can strongly influence it. Therefore risk treatment could mean both, transferring risks and accepting risks.

3.3.4 *Risk monitoring*

Furthermore risk monitoring observes the development of individual risks in connection with the implementation and efficiency of measures and evaluates an adapted risk potential on basis of the current state of the project. This regular monitoring should take place in short intervals ignoring day-to-day business. In this manner the current state of development gets analyzed and particularly deviations and changes are recognised at an early stage so that additional steering measures can be introduced.

3.3.5 *Risk communication*

On the one hand risk communication consists of the ongoing documentation and reports from results concerning Risk Management. On the other hand it means to ensure the structured use of experience for future projects in the sense of knowledge management.

Reporting should be integrated into existing reporting structures as good as possible. Only if illustrated in relation and connection with the cross-linked management disciplines of Cost and Time Management, risk reporting obtains relevant significance.

3.3.6 *Risk review*

The risk review provides the framework for structured learning from experience. Already during the ongoing project development valuable conclusions can be drawn from retrospective considerations at the end of one phase and be used for the subsequent phase. The risk review refers to the development of the general risk potential in the course of time as basis of parameters for plausibility checks of the risk approach referring to the level of risk, individual risks and measures.

Additionally at specified intervals the model of Risk Management itself should be analysed on the basis of experience from application.

3.4 *Prerequisites of Risk Management*

Various experiences from the implementation of Risk Management showed that in many cases certain prerequisites for an immediate and simple application did not exist which led to delays or problems during the implementation. Hence a few essential factors could be deduced which promote the success of Risk Management in a sustainable way. These can be allocated to the human and the methodical factor.

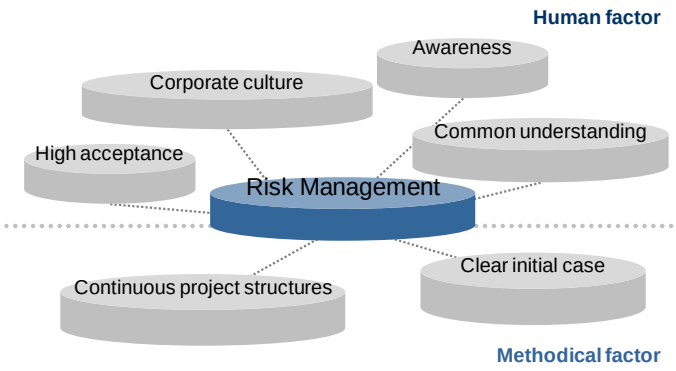

Figure 7. Prerequisites of Risk Management (Waldauer 2010)

It is difficult to talk about a management approach, if there is a lack of the basic premise, the awareness. Only if it is clear to all users, why it is relevant to apply this tool, which personal benefit they gain from it, working with it can be carried out methodically and with valuable content.

The basis of each Risk Management system is a corporate culture and the corresponding communication where you openly reflect and talk about problems and optimization potentials without its necessarily leading to personal measures, allegations or unrealistic requirements.

Often risk and opportunities still get interpreted differently. Without a common understanding the results are not comparable and therefore hardly usable for controlling.

Since essentially risk can be interpreted as deviation from a realistic basic scenario, it becomes necessary to describe the initial conditions as precisely as possible to specify the uncertainties of the basic scenario.

It is difficult to distinguish risks clearly in regard to projects without a good continuous project structure. Therefore a structure has to be defined in advance where Risk Management offers a clear interface towards cost, programme and contract structure.

In order to evaluate risks quantitatively, cost planning and scheduling should be as standardized as possible and should be available in high quality. If the project's costs themselves are estimated with soft focus, the determination of risk costs – which are based on the principle costs of the estimate – can only be carried out grossly and poorly substantiated.

Finally, a positive acceptance of Risk Management has an enormous impact on all persons working with it, enabling them to apply it successfully. Therefore appropriate measures have to be taken at an early stage, to promote and secure this acceptance.

4 APPLICATION OF RISK MANAGEMENT IN LIFE CYCLE MANAGEMENT

The traditional application of Risk Management in construction represents some support during the course of the project, ranging from the project initative till the handover of the object with different intensity and starting at different points of time. Reasonably enough Risk Management gets applied from the start in order to achieve an efficiency of measures as high as possible. The focus here always ranges from the current date to the completion of the construction. Any linked project structures end at this date as well.

Life Cycle Management means to take the future into account. Many people regard this challenge sceptically. Who can look into the future or even design it? Aren't the uncertainties much too big to make a supposedly valid statement?

Risk Management is just the tool which actively deals with uncertainties and identifies them. Via identifications of opportunities for change and deviations their impact can be rated qualitatively and can be analysed according to the level of risk. Thus the uncertainty not only gets a profile, but also the dimension of impact can be assessed.

In regard to Life Cycle Management, the authors' conviction is that Risk and Opportunity Management know additional fields of application and therefore are essential tools for the implementation of Life Cycle Management. Especially if the basic idea of a project development focuses on a responsible way of construction for the future, the implementation of the project demands not to be left to chance and to react to individual problems when they arise, but to act preventively and with an appropriate perspective to the end of the lifetime of an object.

Therefore the authors recommend the following applications of Risk and Opportunity Management to achieve Life Cycle Management goals. The applications represented are tried and tested through practical experience and will evolve continuously within an improvement progress out of the following usage in real estate developments.

4.1 *Analysis of life cycle oriented objectives*

Often general project goals gain more importance during the project development, e.g. by increased demands of users. Interpreting those goals often is up to the project participants with their different access to interpretation.

By means of risk analysis the project's objectives may be acknowledged as feasible if they are coherent in regard to sum and do not contradict but reasonably complement each other in order to limit the project range comprehensively. By means of scenarios it is analysed which specification might occur and how other aspects of the objectives might be affected.

4.2 *Improvement of Life Cycle Costs*

Critics might argue that even with a risk evaluation the actual extent of life cycle costs will not be predictable. One could reply that the absolute amount is less relevant than the awareness and understanding for the relation of influences and their possible modification, if the relevant measures are taken early enough.

Risk Management contributes to an improvement of life cycle costs on two levels. On the one hand it provides an approach referring to the uncertainties in the life cycle costs which is determined in a feasible way. This statement requires that in any case the cost structure comprises all cost areas of the life cycle costs and the risk costs can be attached to the definitive cost category corresponding to their impacts. It would be a methodological error and therefore a false statement, if e.g. a operational risk was attached to investment costs or an constructional risk to operating costs.

The complexity of cost allocation will increase, if measures aimed at preventing risks can be taken other than the phase where a potential risk might occur, e.g. if during the design phase a measure is taken to have a lower risk or an opportunity (cost-reduction) in operation. Thus the cost areas of investment costs rise while at the same time the risk approach for operating costs can be reduced.

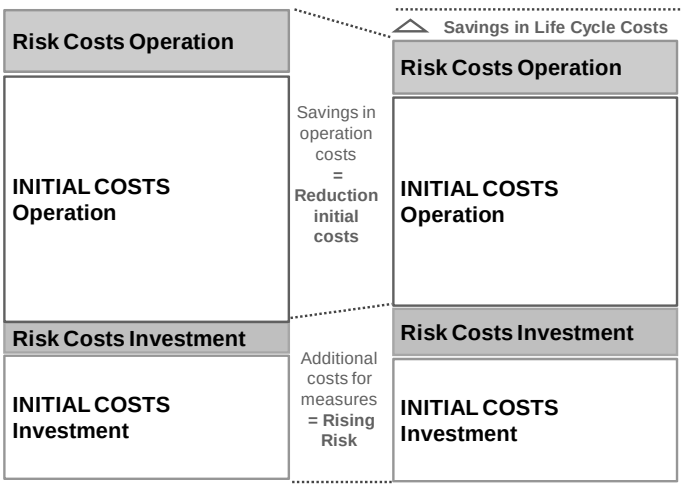

Figure 8. Scheme of development of life cycle costs (Stempkowski 2012)

Apart from deducing the risk approach, Risk Management on the other hand illustrates the model's sensitivities. Here influencing factors of various dimensions are simulated in form of various cases of developments by means of a simultaneity factor chosen at random. Each partial result represents a possible future development. Apart from the conclusion of the most realistic life cycle costs (realistic case), worst and best cases can be demonstrated in a wide range. This additionally raises the awareness of the conclusion's range of variation.

Such comprehensively established scenarios and simulation techniques need a lot of experience in dealing with Risk Management which relates to a responsible and conscious use of simulation tools, full data acquisition, the right combination and interdependence of influences and the competence to interpret and communicate the results correctly.

4.3 *Integrated project optimization – Opportunity Management*

The interpretation of objectives leaves sufficient scope for the implementation in the project. This may also lead to an overachievement of the required qualities in the project design and planning. It is not necessary for example to use material qualities with a durability of more than 50 years if the economic lifetime of an entire building covers 25 years. The main aim is to develop the buildings "as good as necessary" and not "as good as possible".

By means of a consideration of risks but particularly opportunities, project objectives can be compared with the present project state in order to draw a conclusion how the defined project objectives were implemented. Hence potentials can be shown which by respective adaptation meet the demands more suitably while at the same time they influence the life cycle or the life cycle costs positively, e.g. by cost reductions.

By means of a structured approach apart from overachievements, new options get analysed to achieve project objectives in a better way. It is quite possible that conventional and proven methods give way to innovative approaches. Even higher investment costs would be worth considering as measures for significantly lower operating costs, if in total the life cycle costs can be reduced.

4.4 *Project Changes*

Projects de facto are subject to continuous changes during the development. Some of them get accepted quickly, others are discussed for a longer time and sometimes not even decided on. A reason for these deficiencies of Project Management often may be missing bases for decisions. Good preparations dealing with all aspects relevant for a decision are established faster and safer and happen promptly according to the project's requirements.

Even in this case of application Risk and Opportunity Management make a significant contribution. It goes without saying that changes in regard to immediate effects on investment costs and schedules get processed. However, the demand of Life Cycle Management goes beyond that. For that, risks, opportunities for the entire life cycle and the impact on life cycle costs have to be analysed and illustrated as well.

Even for the more difficult communication of increased investment costs, e.g. for obtaining an optimization of life cycle costs, Risk and Opportunity Management provides a suitable argumentation in order to show the positive effects on life cycle costs comprehensibly.

5 CONCLUSION

Life Cycle Management resembles an approach for clients, designers and consultants and contractors. During the implementation all participants of the project are required to adopt the basic idea and involve it in their own performance, to encourage its use and deal with it appropriately. The philosophy behind it provides a significant added value in the three spheres of responsibility – economy, society and environment. Therefore it remains not only a challenge but offers as many opportunities which successful companies use to their advantage.

The main achievement of Risk Management is the increased reliability in design, costs and schedules. For Life Cycle Management it means an improvement of the whole design process and the output. The authors' experience, e.g. from successfully implementing various Project Management and Life Cycle Management systems as well as from operational accompanied building projects, outlines that Risk Management is the main tool to animate Life Cycle Management.

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Further reading

Risikomanagement Bau – Methoden und Erfahrungen bei der praktischen Umsetzung von Risiko- und Chancenmanagement bei Bauprojekten, 2012

In-service training

Lehrgang Risikomanagement Bau bei Austrian Standards plus Trainings www.as-plus.at

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