Realising Blue Buildings?- Life Cycle Management as an integrated management philosophy for blue building projects

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1. A new focus for Blue Buildings

The core question to be discussed seems to be rather basic but difficult: What is a sustainable success of a building? Green buildings reached already a high standard of ecological and technical know-how integrated. Blue buildings suffer from a missing common understanding. They are assimilated with the optimized life cycle costs. Every company would not be satisfied if its economic success was only measured at the expenditure. You have to take the earnings into account too. In future a holistic statement on the long-term success of a building needs to integrate life cycle costing on the one hand which covers the total investments and earnings out of rental income and sale proceeds over the life cycle on the other hand. Sustainable success can then be defined as the optimized mix of minimizing the (life cycle) costs and maximizing the value of the building.

Keywords: Life Cycle Management; integrated design; Blue buildings; value and earnings, controlling of sustainablity.

2. Requirements of Blue Buildings

In construction project management the main goal was to realize the project in the shortest time, at minimum (investment) costs and in the best quality. Today buildings demand to be “green” and “blue” what means to be ecological and economical sustainable. Already the project development faces these new challenges and the change of behaviour of investors and users which occur out of a rising consciousness on the relevance of the operation phase and its costs.

The main question is how to realise the ideas of blue building. What are the main aspects and criteria of blue buildings and what management issues do we have to focus on?
The management philosophy Life Cycle Management in construction is the sustainable way to cope with these new requirements. The core skills of professional construction project management have to be extended with expert knowledge of life cycle oriented design and build.

3. Efficient ways to Blue Buildings

Out of the practical experience there are five main Life Cycle Management aspects which lead to blue buildings and which are presented in more detail:

(1) Focus on life cycle costs instead of investment costs and additionally have the value and the earnings in mind as basis for all relevant decisions

(2) Use systematically experiences out of the operation phase during project development and design and integrate the learnings in the organisation and in design & construction contracts.

(3) Develop a maintenance program for the 2nd and 3rd life cycle in early project phases to enlarge the lifespan and integrate the requirements in the building concept and design.

(4) Apply (long-term) Opportunity and Risk Management in the whole project development process for a continuous project optimization.

(5) Controlling Systems for sustainability to ensure, that the concept of blue building is realized effectively

3.1 Focus on life cycle costs instead of investment costs and additionally have the value and the earnings/income in mind as basis for all relevant decisions

A deeper view on the economic approach of sustainability shows that with the determination of life cycle costs already the impact of the whole life cycle is taken into account. That seems to be sufficient. But sustainability should lead us further to a holistic approach which includes the perspective of investment and earning out of the recovery of the property. There might be economic advantages, if an investor invests more investment costs and even more life cycle costs, if the earnings increase bigger. It will be discussed which investments make sense in a long term examination.

The ISO 15686-5 [1] defines the whole-life cost. They cover the life-cycle cost (LCC) as well as externalities and income. The LCC are divided into the main cost groups construction, operation, maintenance and end-of-life. A sharp demarcation between externalities and environment cost is hard to line in practise. (Find out more at [2])

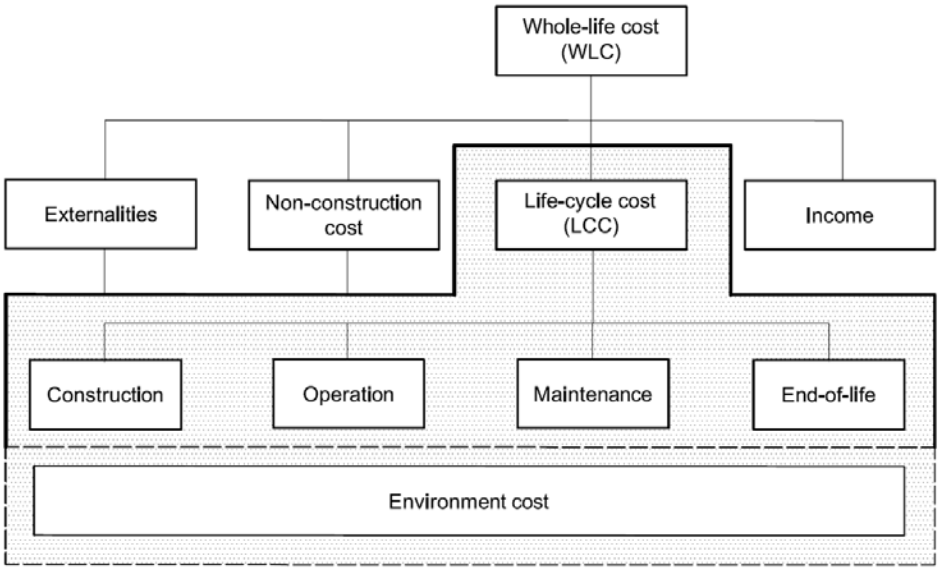

Fig. 1 Whole-life cost - ISO 15686-5 [1]

Focus on life cycle costs

An essentiell decision indicator for realising building projects remains the question of the real arising costs. The consideration only of the investment cost represents just a short-term truth of cost. An actual truth of costs over the entire life cycle can only be reached under the consideration of follow-up costs.

Various analysis of life cycle costs show that investment costs make up only a small proportion of the total life cycle costs (around 15 to 50 per cent depending on the type of object, use and estimated lifetime regarded). Therefore, the total cost planning needs a specific focus on the follow-up costs. The structure of the follow-up costs is detailled in the new Austrian Standard B 1801-2 [3] and can be used as the default for all life cycle cost determinations.

1 administration	administration and management / fees and taxes / space management
2 technical operation	technical building management / inspections, maintenance / small repairs / commissioning, decommissioning
3 supply and disposal	energy (heat, cooling, electricity) / water and sewage / waste disposal
4 cleaning and care	maintenance cleaning / window and glass surface cleaning / facade cleaning / special cleaning / winter service / cleaning public spaces / gardener service
5 security	security services / fire protection services
6 building services	house post / communications and information technology / removals / reception, internal office services / catering
7 repair, modification	major repair / improve, conversion
8 other	other
9 object removal / demolition	planning and organization / demolition and disposal, building the contract state (construction law, easement)

Fig. 2 structure of follow-up costs [3]

Due to the authors' point of view this overview has to be expanded towards financing costs, if the LCC-calculation is meant to determine e.g. the requirement of finances, a liquidity plan or an economic (respectively for tax purposes) result over a specific period.

For an effective cost steering using the life cycle costs it is absolutely necessary to identify the real cost drivers early. Only with this consciousness an ongoing project optimization can start from the very beginning.

A central influence on the determined life cycle costs is the assumed lifetime of the building. The following picture shows an example that makes this influence on the magnitude of the different cost groups pretty obvious.

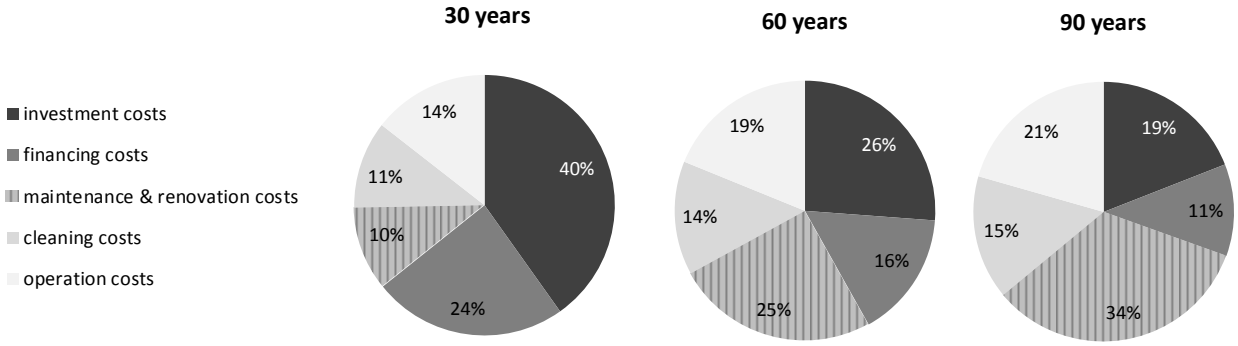

Fig. 33 Makeup of the essential cost parts of the LCC depending on the assumed lifetime [6]

The longer the lifetime is assumed for the cost planning, the higher the time-dependent cost parts like operation and cleaning carry weight. The repair and modification costs rise proportional to the number of operation phases. While in the 30 years consideration virtually maintenance costs are minimal and no modification costs arise, there are extensive repair and renovation / alteration costs for one modification in the 60 years consideration and for two modifications in the 90 years consideration.

So it is simply apparent, which cost components are crucial for a sustainable project success. One of the logical consequences is the focus of all project planning at this cost factors, with the following questions toanswer:

- How can the object be cleaned with minimal effort? (e.g. surfaces inside, facade)
- How can the object be adapted with minimal effort to new user requirements? (eg flexible structures, interchangeable surfaces, upgrading your building services and electric)
- How can the individual components are repaired with minimal effort, bearing in mind that repair work must be carried out at the same time? (Exchange of detailed planning account)
- How can the costs for the technical operation of the building are minimized, especially the staff costs for maintenance and repairs? (Low tech building, simple controls, flexible interfaces)

Consideration of value and earnings / income of the building

The economic success of buildings usually doesn't depend only on the life cycle costs, but also on the earnings from rent, a possible sale or the value of a property. Especially if real estate should be used economically by the owner, the mere consideration of the cost perspective is not enough.

Therefore, the total cost planning should involve the earnings as well including the estimation of possible income or sales proceeds (at different times). Because it can bring quite an economic benefit to invest more in certain parts of the life cycle costs when the earnings can be raised. Successful project developer and operator know exactly which investment in operating affects an increased income and which one will only increase the cost side.

An example will make this theory obvious. The economic lifetime of the surfaces in hotels is getting shorter and shorter; the level of quality is not a warranty for very much longer lifetimes. The best way seems to be to plan simple and cheap measures with a long-term focus, realize them with only a short interruption of the operation and reach the illusion of a true renewal. Than the demand can be increased again which improves the economic results.

In conclusion the author recommends a long-term prognosis that goes over several operation phases and at least 60 years. It compares the life cycle costs including the financing costs to all

possible earnings (taking into account the tax aspects). On this database solid decisions with a holistic life cycle aspect can be made.

3.2 Use systematically experiences out of the operation phase during project development and design and integrate the learnings in the organisation and in design & construction contracts.

While construction project management concentrates mainly on the phases project development, design and build, Life Cycle Management means focusing on all project phases. The whole life cycle of a building - from the start of project development to construction and operation, if necessary alteration and finally demolition respectively recycling of the building - is taken into account. Furthermore a first operating phase (lifetime e.g. 20-30 years) is followed by a second one (till the end of the life cycle) after alteration or altered utilization. Therefore the experiences and knowledge from these phases (operating, alteration and subsequent use) should be used in early project phases.

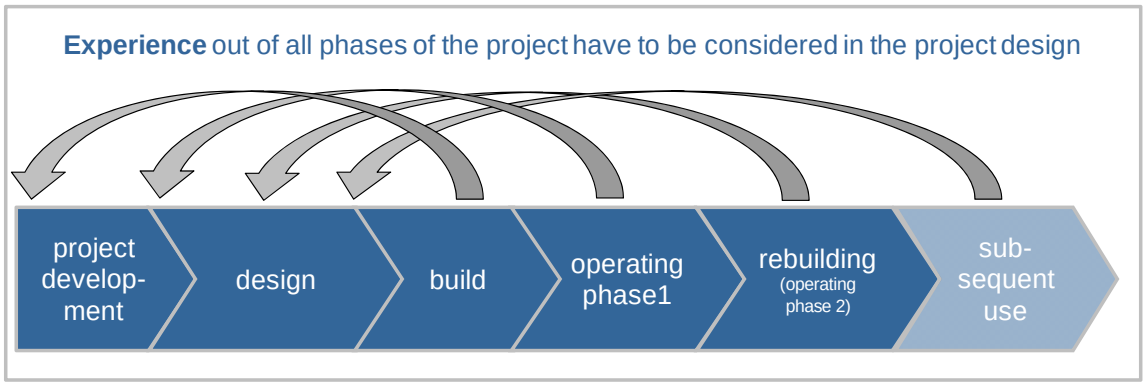

Fig. 4 Experience out of all project phases have to be considered in the early project design [10]

The basically clear demand for optimal use of experience from later phases turns out to be a real organizational challenge in regard to its actual implementation. Depending on the respective form of organization, in many cases the specific operator of the construction project may not be known at the planning phase. Therefore most often an architect whose draft has already set the relevant course is entrusted with the design and further planning process. Subsequent designers and consultants of different special fields can only develop a suitable solution according to these basic conditions.

The Integrated planning team offers a solution-oriented approach. There at a very early stage (project development, pre-draft phase) the entire planning (design) is carried out by a team that involves not only an architect and a structural engineer, but in particular also consultants in the areas of building services engineering, electrical engineering, energy technology, building physics, acoustics, façade construction and depending on the type of project further specialists (e.g. company organization, kitchen designer,).

A key role is transferred to the Facility Management Consultant who provides the experience from the building operation and within the range of facility planning can ensure that the building functions are economically in operation.

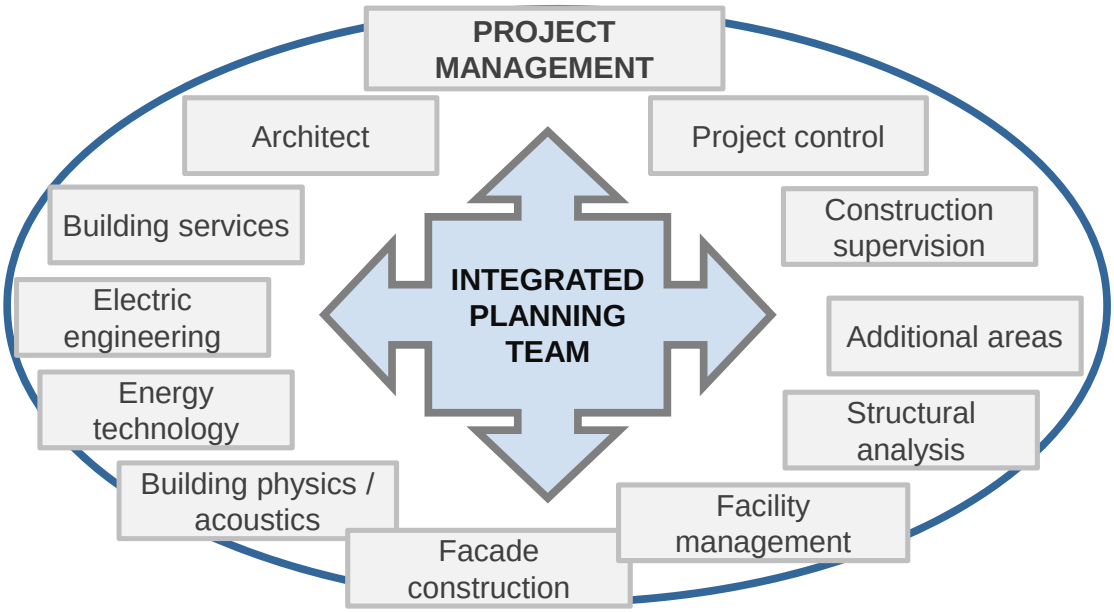

Fig. 5 Integrated planning team [4]

In order to be able to consider relevant experience from the construction phase during the planning phase, in particular concerning the realization of building contracts (e.g. accounting or deviations from specifications), the construction supervision should take an active part already in the phase of preparation, when the specifications and the bill of quantities get established.

An optimal involvement requires the development of a structured process for the progressive introduction of the individual specialists. “At the earliest stage possible” does not necessarily mean that all participants have to meet immediately. Since some specialists need first drafts or the preliminary design before being able to evaluate functionality and profitability, they have to get integrated step by step.

Furthermore, an intensive coordination among consultants and any additional tasks in the course of the joint project optimization have to be taken into account in the scope of work and determination of fees of service agreements.

Another challenge is the development of contracts for all participants, which support the ideas of Life Cycle Management and motivates all participants for project optimization during the whole planning process.

3.3 Develop a maintenance program for the 2nd and 3rd life cycle in early project phases to enlarge the lifespan and integrate the requirements in the building concept and design.

A maintenance program is an important tool to optimize the investments for maintenance, repair, overhauling and services. If the focus is on a 2nd and 3rd life Cycle (that means 60-90 years) and not only on 20-30 years, the importance of maintenance - including alteration - is evident. The experience shows that with this new view the design process and the questions to be answered have to be modified.

Maintenance Program

A Maintenance Program summarizes all measures in a long-term activity plan which are essentiell for the building conservation. In particular, the regular servicing and scheduled maintenance can

significantly affect the life cycle cost. Regular servicing can prevent minor defects to become larger (and thus more expensive to remedy) ones. Out of this thinking it can be derived that a higher investment in the servicing reduces the maintenance costs allocated over the lifetime of the induvidual elements. However, attention should be paid to the interaction between cost and lifespan. Higher servicing costs can extend the maintenance cycles, higher repair investments can prolong the lifetime. The requirement for this is to consider the conditions (market, use options) for the economic lifetime.

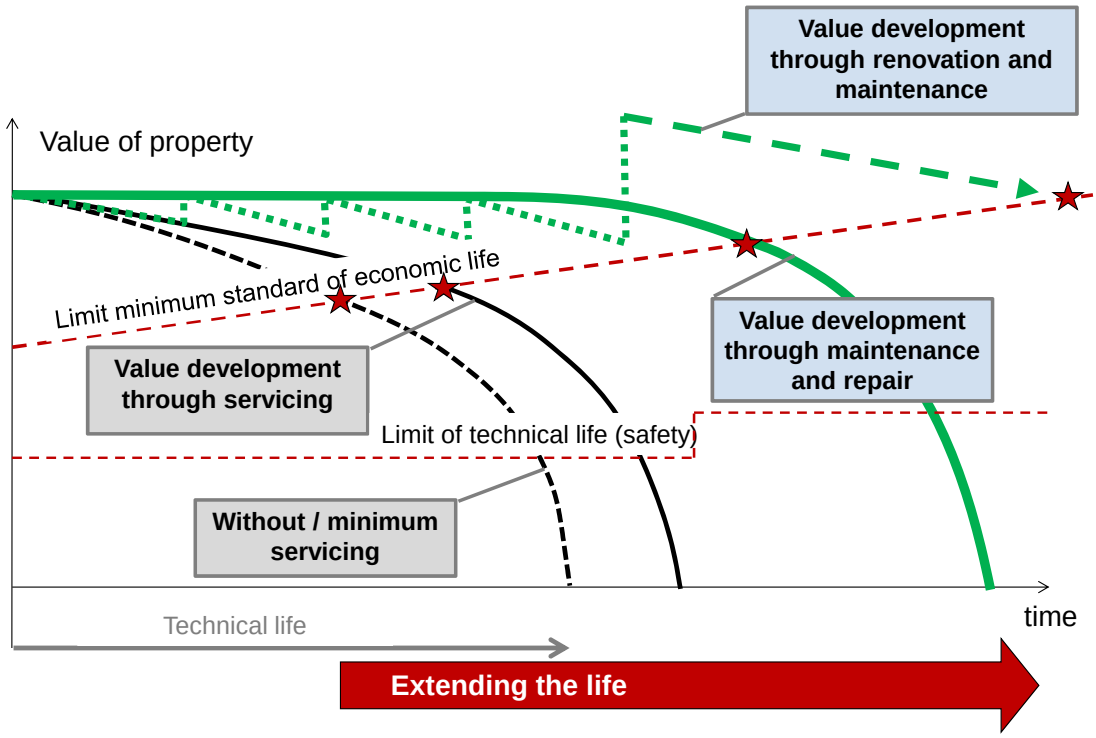

Fig. 6 Dependences between servicing, maintenance and lifetime [11]

The figure 6 shows very clearly that the economic success of a property depends heavily on the extent, kind and timing of appropriate maintenance and repair measures. The best property is always the one that enables the existing substance, the maximum useful service life.

As discussed in chapter 3.1 the maintenance costs are the biggest cost part when based on a long lifetime of the property. In future designers also has to answer these critical questions:

- How can measures for maintenance and repair be implemented?
- How could the building services & electrical engineering be extended and adapted to new user requirements?
- How can the cleaning be done effectively?
- How simple could building functions be adapted to new user requirements?
- What are the options for a conversion?
- How would certain reconstruction scenarios implementable?
- How could a deconstruction of individual components take place?

3.4 Apply (long-term) Opportunity and Risk Management in the whole project development process for a continuous project optimization.

Active Risk Management allows identifying risks early and ensures in the implementation of measures to avoid and reduce risks in sufficient time. Life Cycle Management considers not only risks during design and construction but also during operation and alteration.
Active Opportunity Management ensures that optimization and cost-reducing potentials are efficiently utilized.

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 integrates practical experience, scientific research and trend analysis for the forecast to build scenarios out of different perspectives.

- 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.

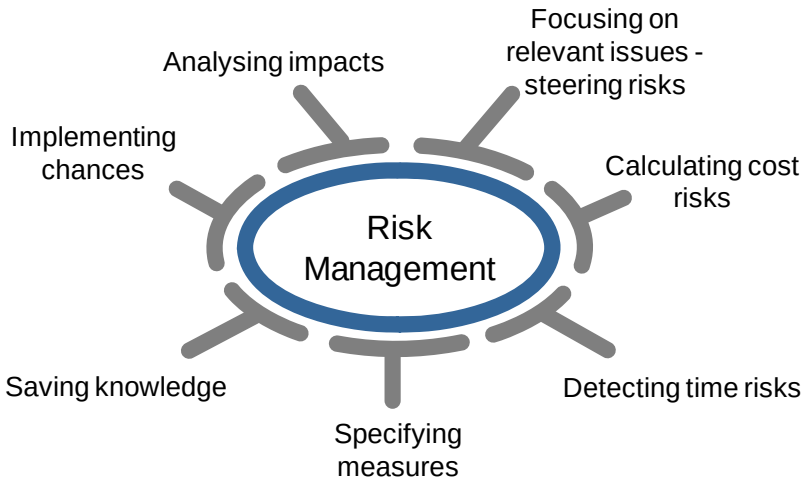

Fig. 7 Elements of Risk Management [11]

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. Risk Management is the main tool to animate Life Cycle Management.

3.5 Controlling Systems for sustainability to ensure, that the concept of blue building is realized effectively

Sustainability and the blue building philosophy is part of the objectives of most real estate projects nowadays. To ensure that this is not just an add-on in the marketing brochure controlling tools are necessary. To achieve sustainable buildings the implementation of controlling tools in all project phase from the preliminary phase to the operation is essential.

Quality control from the project definition to the use

The ability to define quality is easier at the project start. It decreases from phase to phase. For a building project this quality definition should not begin with the building process but at the rather project start like all definitions of aims. In contrast, the control activity increases from phase to phase until it finds the peak of control at the project completion. Afterwards the control activities focus on the use and operation.

Integrated building certification systems represent an ideal system to develop the quality of a building in terms of sustainability (ecological, economic, social) and to examine the requirements for implementation. On one hand the comfort of the user and on the other hand the resource efficiency of the building are assessed in the life cycle. Building Passes serve clients as quality assurance and marketing tool as well as economic and ecological optimization tool. The customers get an objective assessment of housing and building quality. The application of such a principle is more relevant than the decision on a specific type of such a system. The major advantage arises only through the comprehensible definition from quality so it gets controllable and also comparable.

Practical experience from the application of certification systems as quality controlling tools

Public buildings of the province of Vorarlberg provided the analysing base for the development of a quality control system which is built up on the “Kommunalgebäudeausweis” (municipal building ID), a building certification system for sustainable properties. The quality control system deploys the options of an ongoing control and a control in particular after each project phase to compare the definitions of sustainable objectives with the implementation in real. If there are deviations countermeasures can be set in time. The documented results deliver a confirmation of the order and its specifications. The client gets more reliability of the defined quality standards. [13]

With the implementation of a quality control system for sustainability following aspects may be considered:

- Ensuring the implementation of the company's philosophy in terms of sustainability in all building projects
- Specifying the quality objectives more detailed by the definitions in the context of the certification system
- Ensuring the achievement of the quality objectives by the ongoing evaluation and early identifying deviations
- Possibly using the results for the marketing

4. Conclusions

The authors’ experience, e.g. from successfully implementing various project management and Life Cycle Management systems, provide the following success factors for developing and constructing sustainable building projects:

(1) Focus on life cycle costs instead of investment costs and additionally have the value and the earnings in mind as basis for all relevant decisions
(2) Use systematically experiences out of the operation phase during project development and design and integrate the learnings in the organisation and in design & construction contracts.
(3) Develop a maintenance program for the 2nd and 3rd life cycle in early project phases to enlarge the lifespan and integrate the requirements in the building concept and design.
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One does professional Life Cycle Management, if all above mentioned demands are met in a satisfactory manner.

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