

Technical life cycle service concept

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1 Abstract

Real estate business is developing fast. The development needs are challenging because of interdisciplinarity and diverseness of the branch. The main mission of real estate business is to provide premises for its customers. In addition the current discussion about work environment and organisational development (Joroff 2001, Alexander 2001), creates challenges for both FM (Facilities Management) and CREM (Corporate Real Estate Management). The challenge changes to be more difficult when taking into account the hectic tempo of business life and changing needs and requirements of it as well as changes in society and possibilities of developing technologies.

Designers are planning the buildings, contractors are building them and owners are supplying premises for users. During the use the real estate market needs different kinds of services directed to users and/or owners of buildings. These services are either internally provided or outsourced according to organisational structure of the owner organisation. FM can be seen as an integrated approach for maintaining improving and adapting the buildings of an organisation in order to create an environment that strongly supports the primary objectives of that organisation. (Barret 1995,also: Brown 1993, Schulte 2000, Joroff 2001, Alexander 2001). CREM according to Bon covers the entire range of activities concerning portfolios of buildings and landholdings held by an organisation: investment planning and management, financial planning and management, construction planning and management, facilities planning and management and reuse and disposition of property (Bon, 1994, Bon 1999).

As the business of real estate sector is based on built property, and as the owner (investor or non-property company) has invested plenty of money on premises, the strategies for developing and maintaining buildings can not be meaningless. For achieving a satisfactory and profitable life cycle, the goals and visions should also be defined for technical life cycle - already in project planning phase or even in investment analysis phase of the new building. The technical life cycle (TLC) service concept is possible to define as a strategy for achieving the goals. Technical life cycle services are connected to technical possibilities and risks in investment analysis phase and decisions in project planning phase – decisions that have an effect on maintaining the built property to achieve stable distribution of life cycle costs and maintain or even improve the value of investments.

At the moment TLC- concept is composed of projects provided by different service providers but only rarely the totality of a building and its environment is taken into account at the same time. However the strategy – the life cycle concept - should be continuous, seamless, long-term strategy, well documented and designed according to visions and goals of the owner organisation.

The parties of technical life cycle management are shown in figure 1

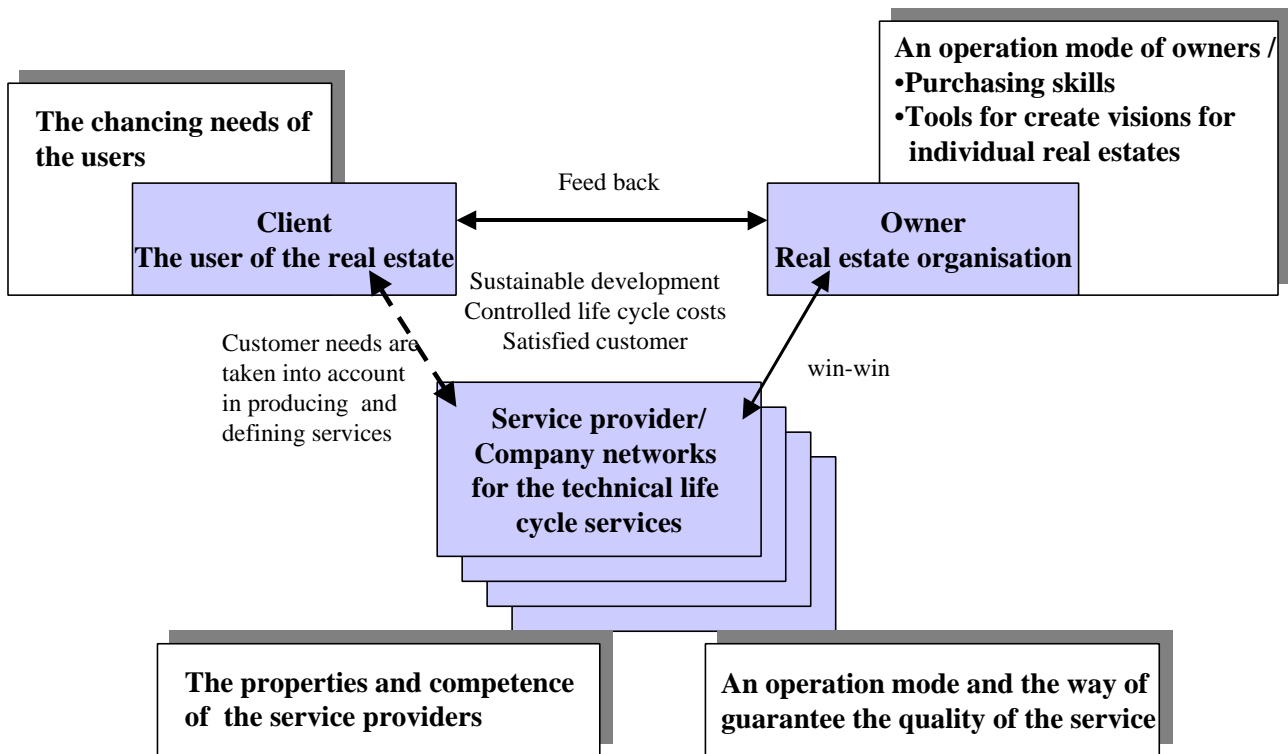


Figure 1. The parties of the technical life cycle management of real estates. (TK 2000)

2 Aims of the study

This article is a part of a development project “Purchase model of technical life cycle service concept”. It is a short abstract from the results of literature review and interviews made for gathering pre-understanding of the subject. The objectives of the project are:

- 1) To define a technical life cycle concept (TLC) of real estates and the critical tasks of it.
- 2) To define the role of technical life cycle management as a part of corporate real estate management (CREM)
- 3) To define the critical points of technical life cycle decision making
- 4) To construct a purchase model of technical life cycle services.
- 5) To define the critical know how of a competent TLC-service provider.

In this article the main ideas and intuitions about technical life cycle services are presented.

3 Methods

The project is a development project led by 6 real estate companies and service providers in the capital area of Finland. The project started on spring 2000 with a feasibility study. During the winter 2000 the literature study about the topics connected to real estate business, life cycle of real estates and purchasing of technical life cycle services has been carried out. The dissertation study based on ideas emerged from this pre-understanding will be carried out by using a constructive research method.

The aim of the feasibility study was to clarify the following questions from the managers of Finnish real-estate companies or real estate departments of non-property companies:

- 1) How do they define their needs in buying technical life cycle (management) services for their real estates? Is the technical life cycle management an important field in the real estate sector?
- 2) Do they have technical life cycle strategies for the real estates in practice? If not, should they have?
- 3) How are they organised, what is the critical know-how they need in their own organisations?
- 4) How and from whom do they buy the technical life cycle services and how the services should be bought?
- 5) How do they measure the quality of the services
- 6) How the real estate business is going to be changed in the future?

The study was a feasibility study for defining and specifying the research question of the dissertation work and for evaluating the relevance of constructing a new concept of technical life cycle services and a purchase model of technical life cycle services for real estate managers.

The research work was made as a half structured qualitative interview-study. In every interview the same questions were asked and the answers were written down as accurately as possible. The answers were verified by the interviewees. After that they were classified and interpreted. In the conclusions the results are compared to literature from Finland, Sweden and Germany. Every interview lasted 1-3 hours. A total number of 27 real estate managers or other opinion leaders within the real estate sector in capital area of Finland were interviewed.

The literature review on the real estate business includes the topics as follows:

- 1) Framework for real estate economy
- 2) Concepts within the real estate branch
- 3) Strategies within the real estate business
- 4) The life cycle and the technical life cycle of the real estate
- 5) Purchasing of the services, core business and core competence of a real estate company

In this article the pre-understanding from the literature is compared to the results of the feasibility study. In paragraph "Discussion" some conclusions and suggestions are presented.

4 Results of literature and feasibility studies

4.1 Responsibilities within the real estate sector

The real estate sector is interdisciplinary. Different kinds of parties are involved with different aspects and different interests according to the role they play in real estate business. The whole business is based on buildings and on people that are using these buildings. The real estate owner is an investor whose interests are both the building and the users. According to the interview study non-property companies were in practice more interested in supporting the core business needs of the users than real estate companies. That may be as a result of the dualistic clientele - users and shareholders/investors.

According to the interviews the real estate sector will be changed in the future as follows (Koskelo 2000):

- ?? Real estate strategies and especially total life cycle strategies will be important decision making tools in the future.
- ?? Partner relationships are going to be more and more common.

- ?? Almost all tasks except the over all management will be outsourced, probably not for one or two service providers but a few.
- ?? Qualified personnel are going to be hard to find: Real estate management is the core competence of real estate companies and better purchase and management skills are needed.
- ?? More attention is going to be paid to expenses.
- ?? The business is not going to work if the returns will not increase in the future.
- ?? Importance of properties like flexibility, healthiness, economical use will be increased
- ?? In the future, there is going to be paid more and more attention to total life cycle costs.
- ?? In the service sector the services will be divided into two parts in the future: “user services” and “owner services”: Services for the user organisation of the real estate and services directed to the owner of the real estate

Central definitions within real estate sector are for example CREM, FM, and AM (Asset Management). Accurate definitions do not exist but generally could be said that the FM-services are mainly directed for the user of the real estate. Definition of FM by Barret is as follows: FM is “an integrated approach for maintaining improving and adapting the buildings of an organisation in order to create an environment that strongly supports the primary objectives of that organisation.” (Barret 1995,also: Schulte 2000, Alexander 2001).

Bon writes about the organisation, which takes care of the real property. He emphasises the importance of managing the real estate from the aspect of the building. (Bon, 1989, also: Toure1999). He defines the CREM as follows: (Bon, 1994) “Corporate Real Estate Management covers the entire range of activities concerning portfolios of buildings and landholdings held by an organisation: investment planning and management, financial planning and management, construction planning and management and facilities planning and management.” According to previous definition the technical management is part of CREM and the services connected to the building itself should be directed to owner of the real estate. In this article these services are called as technical life cycle services (TLC).

Brown (Brown & al 1993) defines Real Estate Asset Management as follows: Real estate asset management is a “general *process of managing all aspects of real estate assets*, including acquisition and disposition, devising *management strategies, management of buildings* and facility operations, financial management and all aspects of accounting and reporting on real estate held. The corporate real estate executive (= the real estate director or manager) will also be responsible for developing information, *assisting or co-ordinating decisions regarding property or facility operations, devising procedures and executing policies to achieve real estate objective.*” He continues: “Facilities Management is the general function of *co-ordinating the needs of people, equipment and operational activities into the physical workplace.* When FM is performed by an *in-house organisation*, it usually refers to performing those activities dealing with the *acquisition and disposition, physical upkeep and reporting tasks for corporate owned real estate.* While the corporate real estate executive has historically the strategic planning effort in a very important advisory, proactive role, he or she is increasingly becoming an essential participant in the strategic planning process. FM reports to corporate real estate executive.”

An addition Salokangas has defined the real estate management tasks. According to him the owner is responsible for the whole technical life cycle of the building (Toure 1999). Even if the owner had outsourced all the technical life cycle tasks, he/she should be the party who has invested on the real estate.

According to the interviews in Finland (Koskelo 2000), Technical life cycle concept is assorted partly to FM-services and partly the concept is connected to CREM. Some of the interviewees connected TLC more to FM services some of them pointed out that TLC-services were services for building and owner of the building. In figure 2 the technical life cycle management as a part of CREM and part of FM and its connection to the users of real estates is presented. According to the figure numbers:

1. Technical life cycle makes it possible to offer satisfactory premises (not facilities) for customers of real estate business. *Customer* needs like IAQ; flexibility, healthiness, image questions and economical use are connected to technical life cycle strategies and implementations.
2. One of the most important tasks of corporate real estate management is the creation of visions and mission for the business. The Visions need strategies to be implemented. Technical life cycle concept is a strategy for technical life cycle of the real estate. In creating long-term strategy it may be important to consult the experts to evaluate the relevancy.
3. Maintenance and cleaning instructions sometimes depend on architectural or building physical design decisions. Some of the tasks connected to the maintenance of buildings are knowledge intensive and need theoretical understanding implemented into practice.

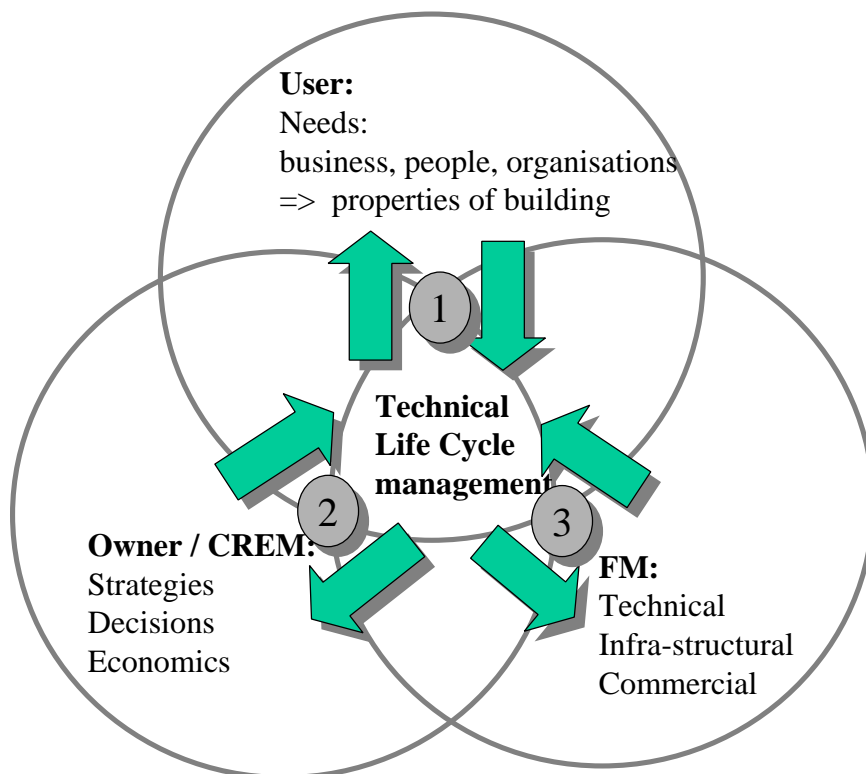


Figure 2. The technical life cycle management as a part of CREM and FM and its connection to the users of real estates. (Koskelo 2000)

The owner organisation of the real estates is the party who is responsible for strategic technical life cycle management. It has invested on fixed assets which should be cared. The technical life cycle decisions have an effect on the profit of both owner and user organisations of the real estate.

4.2 Strategies

According to Ulrich Gilbert (Gilbert, lecture in EBS 2001) the main objectives of the strategic management of the real estate company are:

1. Minimising the risk of incorrect decisions by controlled development of the strategy
2. Controlling the whole spectrum of the business area.
3. Strategic inspection of the opportunities and the threats in early stages.
4. Managing the company, systemising of the future planning.
5. Building and maintaining the success potential of the company
6. Integration of the single decisions into the main decisions
7. Building a framework for operative managing

Competitive strategy is a combination of the ends (goals) for which the firm is striving. The definition of how the business is going to compete and the objectives for profitability, growth, market share social responsiveness etc. and the means by which the goals will be achieved. (Porter 1980)

Which are the goals that should be achieved in real estate business? Which are the goals connected to technical life cycle of a building?

Many authors and lecturers have pointed out the meaning of the strategies in the real estate business. (Manning & al. 1997, Loch 2000, Bon, 1989 Toure, Joroff 2001, Lundström, 1999, Kaleva 1998, Ojala 1999) Generally the user defines a FM-strategy and the owner a real estate- or an investment - strategy. In both the technical life cycle of the building should be taken into account (Koskelo 2000)

The core business, the most important tasks, of a real estate company are according to Lundström and interviews are as follows (Lundström, 1999, Koskelo 2000):

- 1) To create **a vision and a mission for the business**, to create **strategies for achieving** the visions
=> business idea, market area
- 2) Decisions connected **to real capital**: make **decisions** related to **acquisitions, selling and maintaining** of the property, as well as decisions connected to **renovations, etc.**
- 3) Decisions that have a direct connection to **financing questions**,
- 4) Decisions that have a direct influence on net operating profit, and indirect influence on real capital
- 5) Questions that have a connection to the cash flow: Structure of the organisation; decisions between internally service providing or outsourcing, questions connected to information flows as well as questions connected to personnel- and environmental- policies.
- 6) Upkeeping of business activities of the company.
- 7) Decisions connected to normal infrastructural service providing of the company: catering services, telephone and data networks, cleaning and security services.

Are the real estate companies and the real estate departments of non-property companies led by using strategic business planning?

Manning (Manning & al. 1997) points out, that “25 % or more of corporate assets are in real property and occupancy costs of corporate space represented 40%-50% of their net operating income, yet many companies still claim that they are not in real estate business. Such statements are true from very narrow perspective and from larger perspective such thinking is naive and dangerous – this because the success of all large business today, admitted or not, depends upon how well they manage their human resources, capital, information systems and investment in fixed assets.” Also Bon points out the importance of managing real estates. According to him (Bon, 1989, also: Toure, 1999) there are plenty of good reasons to pay attention to fixed assets. Fixed assets are not taken care of at the level they should be. Real estate units are usually evaluated as cost productive not productive units. In addition if there appears new needs connected to the real estates and premises, it is more common to build a new building instead of developing an existing one.

Creating and defining the visions for business is one of the most important tasks of the corporate management in real estate companies and in non-property companies. The visions should be informed in a clear and effective way to the whole organisation – also to the real estate departments of non-property companies. (Joroff, 2001, Interviews 2000) However, for example Loch points out as follows (Loch 2000): Nowadays anything that is non-core for the companies has been marginalised or outsourced, or both. He says that somehow non-core has come to mean non-strategic, non-relevant and non-important. He wonders “how many facilities professionals for example can even quote the corporate mission statement or can outline their organisations three-or-five-year goals. Or are intimate with this years business plan.”

The real estate owner should perceive the possibilities of the planned strategic management of the technical life cycle of the buildings. According to Benda (Benda & al. 2000) the asset value of a building, the measure of its worth in financial term, is related to how the building is designed, constructed, operated and maintained. Technical life cycle management has an effect on both users and owners of the real estates. For the users it is possible to offer healthy, safety, flexible work environments that strongly supports the primary objectives of the organisation and for the owners it has in a long sight a clear effect on net profit. Benda (Benda & al. 2000) continues: “An owner typically creates a “brittle building” by selecting features with the lowest first cost for construction or renovation. These selections are often based on the advice of the building professionals the owner has hired. By ignoring impacts caused by the poor quality of the environment, lack of flexibility for future use and occupancy, and the lifecycle costs of equipment and materials, the owner chooses the path of limiting or reducing the asset value of the building in which they invest. A brittle building is created. By understanding the resilient building equation, the owner can make more rational choices, resulting in a building characterised by its ability to adapt to changing tenant needs, few complaints, low maintenance and energy costs and high tenant retention. All these factors contribute to a building that can be appraised at its highest value at the time of sale, which reflects its true asset value.”

Ratcliffe points out that even if the property industry is constantly cited as being one of, if not the, largest business activity in any economy, and yet its record of foresight is poor. “All too often property markets are caught out by unforeseen events or the unforeseen consequences of planned events.” According to him the real estate sector should have *better methods of appraisal, analysis, prediction and planning for improving future decision making in real estate investment, development, management, marketing and valuation.* (Ratcliffe, 2000)

Also Flanagan (Flanagan & al. 1989) writes about the importance of scenarios. He points out the importance of scenarios about life cycle costing and forecasts of using of building, periods of occupancy, needs connected to use, forecasts about maintenance etc. The risk analysis of critical structures, indoor air quality and needs, inter action of material combinations and other building physical factors have an affect on life cycle costs, user satisfaction and salvage and residual values of

the building and should be taken account in scenarios (Interviews 2001). Also Flanagan continues: there are “ numerous books and articles concerning the benefits of using life cycle cost approach in evaluating buildings, elemental parts of buildings, systems or the components and materials used in buildings. Therefore the life cycle costing techniques has an very important role to play in decision making”.

Many authors and lecturers and interviewees (Ratcliffe 2000, Alexander 2001, Joroff 2001, Schulte 2000, Interviews 2001) have in addition pointed out that in real estate sector it is essential to be able to take into account factors like the impacts of cultural, demographic, economic, environmental, governmental and technological changes as well as changes in business world upon international, national, regional and local real estate markets. It is also important to investigate more closely and creatively such obvious property-related issues as the changing nature of work and the future of the office; advances in information technology and the potential consequences for retail and residential real estate development. *The whole real estate sector should be seen more as a totality.*

According to interviews (Koskelo 2000) individual long-term technical strategies for real estates (technical life cycle strategies) in Finland did not exist due to two main reasons:

- 1) The situation in real estate business was considered confusing. The organisations are changing and trying to find their optimal organisation structures. They presently define their core business and core competence areas and knowledge areas that are important to their business. They define their visions and goals. Some of the companies have “wrong kinds” of real estates and sometimes “wrong kind” of personnel. To clear up first the “confusing” situation in their core business is considered more important. When this is done they can create strategies for their property development. Non-property companies are organising their real estate departments and defining the role of these departments in corporate management (Koskelo 2000).

There were differences in opinions connected to priority of technical life cycle between real estate companies (Insurance companies and Property holding companies) and real estate departments of non-property companies. In addition the type of real estates caused differences in requirements between these two types of owners. Also opinions about customer orientation had differences (Koskelo 2000).

For the real estate companies (Insurance or Property holding companies) the most important thing was to improve the ROI. The whole business is based on annual profit and thus the visions and strategies are more concentrated on yearly-plans (Koskelo 2000). Also Horner (Horner & al. 1997) pointed out this problem: “Current building maintenance strategies, whether based on planned or unplanned maintenance, are most likely to be budget driven. This means that maintenance is not carried out according to actual need, but is dictated by financial priorities decided at the time or during the previous 12 months. Although theoretically the budget should be built up as a result of estimated needs.” According to Tsang (Tsang 1998) it is typical that the maintenance function is perceived to be confined to the tactical role of maintaining, servicing and fixing facilities already in place. With such a perception, maintenance is often regarded as an expense account, a popular target for cost reduction programmes the maintenance of assets is a strategic question.

According to interviews (Koskelo 2000) technical life cycle strategy was in long sight considered important to define, but it was also found to be a *difficult task to do*. The managers of real estate departments of non-property companies were oriented to solve problems connected to availability, flexibility or image questions of premises, and they were clearly interested in fulfilling the user expectations and needs related to premises. Their main mission was to offer premises for the

“business makers” of their company and thus the customer/user needs were important to them, also needs connected to IAQ and healthy, safe and economical buildings. In some cases the day-to-day needs were more important than the sustainable life cycle process - which was considered important but there were no resources, competence or time available to create a concept for doing that. Only few of all interviewed managers tried in practice to create technical life cycle concepts and they considered it important for also customer satisfaction in the long sight. (See also Benda 2000)

Outsourcing services and at the same time having the co-ordination in the own organisation was considered to be the right decision. But how and to whom the different parts of CREM/FM services should be outsourced, was the unsolved question (Koskelo 2000).

Real Estate sector is very interdisciplinary and thus, it is difficult to find skilled personnel. Critical know how for personnel making decisions related to technical questions and purchasing outsourced services is not defined. Better concepts for managing technical life cycle are needed (Koskelo 2000).

The second reason for the lack of technical life cycle strategy in practice was that:

- 2) There are a lot of changes in service provider sector. Companies are making strategic alliances and they are buying each others, their core competence and core business is not quite clear for most customers. There are no qualified comprehensive service providers available. Qualified service provider company nets are not available. Required quality of technical life cycle services is not defined. The quality is hard to define and hard to find and very difficult to measure the competence of service providers (Koskelo 2000).

Also Benda (Benda 2000) pointed out that when strategies were made and professionals were used as technical life cycle advisers, the professionals were those whose advises typically caused a “brittle building”.

Is it relevant to ask if the needed competence in technical life cycle management could be emphasised in a different way than usually in traditional building trade?

4.3 The life cycle of real estates

Real property life cycle can be divided into a few main phases. The life cycle of land can be considered eternal. The life cycle of a building can be differentiated between the technical and economical useful life (Halder 1999). In addition different structures and parts of the building can have different kinds of useful life cycles. It is profitable to design buildings according to owner and user needs (RIL 216, see also Flanagan & al. 1989) and taking into account possible user lifecycles or changing demands and requirements of business life - its organisational and technological demands. (Joroff, 2001, Schulte 2000, interviews 2000, Flanagan 1989). RIL defines the life cycle as follows (RIL 216, 2001): “The life cycle of the building includes all the phases of the building and its parts from acquisition and producing of raw materials till disposal of waste of demolished building.”

The life cycle of the building consists of the phases as follows. The phases are also shown in figure 3:

- 1) Land acquisition
- 2) Development of the building
- 3) Utilisation of the building
- 4) The time after utilisation, building is vacant

- 5) Redevelopment phase
- 6) Second utilisation
- 7) Demolition of the building

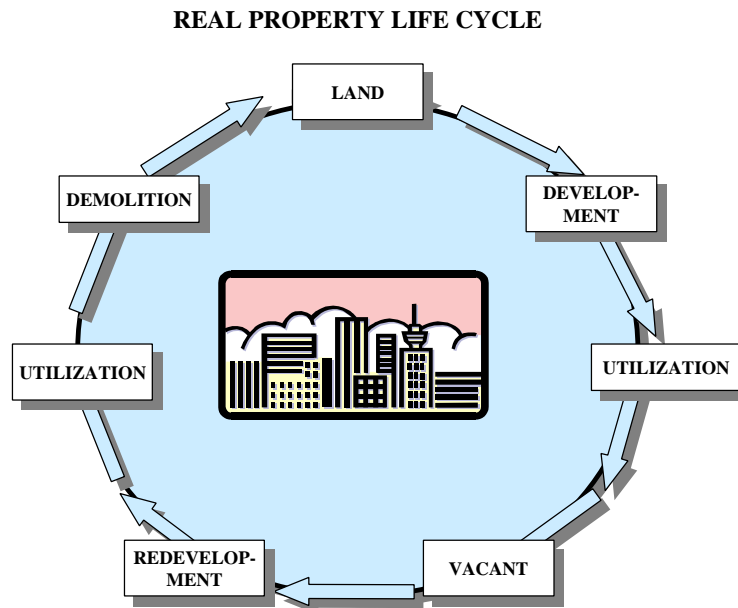


Figure 3: Life cycle of the building (adapted from Halder 1999)

Development of the building

According to Zavadskas, “the lifecycle of the building begins on the phase where the purpose of it is determined. In that phase the demands for the building are defined and the limitations are specified”. (Zavadskas & al.1998).

As the technical life cycle of a building bases on the definitions connected to technical aspects of a real estate; its use, owners expectations, limitations during the use and all the technical aspects and risks that can have an effect on users, and a healthy, safety, economical use of the building, the owner should define in investment analysis phase or at the latest in project planning phase the visions and goals connected to following factors:

1. Who will use the building and how it will be used (Flanagan 1989)
2. Periods of occupancy, how long the investor is going to keep/ own the building (Flanagan 1989)
3. Expected life cycle of the support and infill parts of the building (Gransberg 1997, Interviews 2000)
4. IAQ (indoor air quality) healthy, safety, satisfaction of the users –related aspects (materials and other indoor air related matters (Sobotka 1998, Horner 1997, Benda 2000)
5. Flexibility of the building (Benda 2000, Gransberg 1997, Interviews 2001)
6. Mainenance (Zavadskas 1998, Horner 1997)
7. Energy efficiency, (Sobotka 1998)
8. Ecological level (Sobotka 1998)

9. Economical objects and expectations for rate of return, costs, residual value (Flanagan 1989, Benda 2000)

When the goals are defined, it is essential to find a competent project team for designing and construction phases.

It is possible to achieve all the goals that have been set for life cycle and technical life cycle of the building by using integrated life cycle design, the comprehensive design of the total building and its parts where the following two characteristics are taken into account: (RIL 216)

- In planning all the requirement groups are taken into account.
- In planning the whole design lifecycle with all its features and time periods is taken into account.

Zavadskas points out that while the design stage includes technical and architectural calculations, drawings, specifications, estimate preparation, etc. therefore also at this phase, maintenance strategies and objectives as well as the means to be used to achieve them should be determined. (Zavadskas & al. 1998, also: Koskelo 2000) He continues: “The *extent and efficiency of maintenance* depends on the *volumetric-planning and design solutions*, as well as on the *quality of materials, structures and engineering services, the capacity to satisfy the requirements of a user and other factors*. A maintenance specialist should be involved at the design stage of project realisation to ensure that *maintenance problems are taken into consideration at very beginning of design work*.” (Zavadskas & al. 1998, Italics by Koskelo)

Integrated life cycle design makes demands on the choice of a project group and a project management:

When the investor/owner has defined the goals and the demands for the building, he should be able to choose the architects, designers and constructors competent enough for the current project (Trivers 1999a). Levin points out that importance in healthy building projects as follows: “designers and constructors should be able to show how they have done similar projects earlier and achieved good IEQ results. They have to be able to prove that their personnel is well trained and motivated and that they know what IEQ sensitive construction is how it affects their work. They should work with a quality control plan and a systematic approach to ensure future building performance.” (Levin & al. 2000) Also Gransberg emphasises the importance of right selected project team. The aim of the team selection according to him is to choose such a customer-focused and results-oriented project team that can achieve all the operational, budgetary and schedule goals that are set to the entire life of the building. The project team consists of for example the parties of owner, constructor and technical consultants. (Gransberg, 1997) Also Pekkala points out the role of the owner. According to his study (Pekkala 1998) the owner/ investor wants to be in central position all through the construction project being able to supervise the project in all its phases. The owner/investor wants as well that all the parties in construction project have a direct relation to the owner.

Gransberg emphasises that the purpose of the team selection phase is to find a design team that is *competent enough to satisfy the long-term project goals*. According to him, the lead designer joins the life cycle project management team. In pre-design activities –phase a partnering session may be held to further reinforce the new relationship and ensure that the project needs of the owner are fully understood by the team members. (Gransberg 1997) He continues that the “excellence in construction management starts with excellence in project management. According to him the life cycle project management is the management of the entire life of a project from conception phase to warranty-close out. The construction management is only a phase in what should be a *seamless project management process*.” When the traditional project management starts in concept-, design- and feasibility- study- phase continuing through the design-phase to the construction, commissioning

and closeout warranty activities, the new life cycle project management includes the whole serie of phases before starting the design. (Gransberg 1997)

Also Levin points out the importance of “ pre pid conference” which aim is to explain IEQ (healthy building-) objectives and reduce uncertainty among potential bidders. It is critical to the potential bidders to understand the importance of indoor environmental quality and the aspects of construction that will affect the quality of construction and the indoor environment in the completed building. The potential bidders should also be familiar with the nature of the products and processes that will be needed. (Levin & al. 2000)

Auditing –phase

Auditing –phase of the building is very critical from the point of view of technical life cycle of a building. In this phase, it is important to make sure that the whole construction project is carried out taking into account all the technical life cycle demands and goals for the building. Gransberg wrote about “commissioning” as follows: “Commissioning the building is much the same as commissioning the battleship” (Gransberg, 1997). He continues: “In construction project all the plans and documents developed in the previous phase are implemented at this time. The people who must make the facility work, must understand the design parameters – and must be involved in this phase.”

In auditing -phases the building with its defined and created maintenance strategy is taken into a use. All the instructions for maintaining and using the building and all the technical characteristics of the building should be available - documented in maintenance book. The first renovation cycle should be pre-designed (Interviews 2001).

There are numerous components and performance criteria that may in commissioning phase require testing, for example the HVAC-system, tightness of an envelope, resistance of structures to moisture intrusion, window and door leakage of air and water etc. It is important that the party who makes the verifications and commissioning must be independent and the commissioners should be certified. Remarkable is that in this phase there are already such critical details in the building that should be inspected but the inspection is not possible because of coverings. Such details are for example: Integrity and thickness of the moisture barriers in bathrooms. That must be verified before tiling. And the proper operation of drainage system must be verified before backfill of foundation. These inspections should be commissioned during the construction phase. (Levin & al. 2000). These inspections are called as quality assurance tests. In integrated well planned life cycle management process all these are documented and carried out in a right way in a right phase (Interviews 2001).

A technical life cycle process starts before the building is constructed. Documentation is important for example when the building is going to be sold or purchased, renovated or even demolished - it is important to know by which criteria has been used in designing phase phases, what are the planned life cycles (support- and in-fill- parts) and for what kind of use the building is planned (IAQ, flexibility, etc.). The importance is emphasised when the propriety of purchasing an existing real estate is considered in proportion to the costs, the risks, the possibilities and the life cycle expectations of the building and its parts.

Maintenance strategy

Strategic planned maintenance together with strategic planned construction and strategic business vision planning makes it possible to maintain the real property. Tsang (Koskelo 2000) points out the importance of strategic planned maintenance: “Considering maintenance a purely tactical matter is myopic. It also has a strategic dimension covering issues such as design of facilities and their maintenance programmes, upgrading the knowledge and skills of the workforce and deployment of tools and manpower to perform maintenance work. These decisions have lasting effects on the future operation and maintenance (O&M) of physical assets. With this broadened view, *strategic issues relating to the acquisition, improvement, replacement and disposal of physical assets will fall into*

the domain of maintenance. Obviously, the scope of this enlarged view also includes the proactive tasks such as routine servicing and periodic inspection, preventive replacement, and condition monitoring.

There are four steps in strategic maintenance performance process according to Tsang:

- 1) Strategy formulating,
- 2) Operationalising the strategy ,
- 3) Developing action plans to achieve the strategic objectives and
- 4) Periodic review of performance and strategy. (Tsang 1998)

Zavadskas defines maintenance as follows: “Adequate maintenance should be provided throughout the entire lifetime of a building ensuring that a building and its facilities meet the requirements raised by the users and specifications.” (Zavadskas 1998) The maintenance strategy should be done according to the needs of the clients, users of the building and according to the needs of owners. Maintenance program depends on structural details of the building and its use.

Horner presented a new approach to building maintenance strategy. His strategy is aiming at reducing the maintenance costs of existing building stock. According to Horner: “current building maintenance strategies whether based on planned or unplanned maintenance are most likely to be budget driven. This means that maintenance is not carried out according to actual need, but is dictated by financial priorities decided at the time of during the previous 12 months. Although theoretically the budget should be build up as a result of estimated needs. Maintenance can be divided into 3 strategies (Horner 1997, see also Smith 2001):

1. Corrective or reactive maintenance – failure-based maintenance
2. Preventive maintenance - interval-based maintenance
3. Condition-based maintenance - predictive maintenance

The strategic choice between these maintenance methods should be done according to the significance of the item of the building. Significant items are those whose failure affects health, safety, environment or utility, including costs. Non significant are those items whose failure has no significant effect.

According to Benda planned construction and maintenance causes user satisfaction and this has a direct influence on the cost effectiveness of the business. (Benda, 2000) *Therefore it could be said that it is essential to connect the strategic technical life cycle management to decision-making processes of the corporate real estate business.*

Renovating, demolishing and building new, or purchasing an existing real estate

When the real estate does not perform anymore in satisfying way, the owner should consider building a new real estate and demolishing the old one, purchasing an existing new or old real estate, or just selling the building. All these decisions are critical from the point of view of the technical life cycle management.

In these points the physical condition of a building and its parts, structures and plants should be assessed. The remaining lifecycles should be determined, the renovation costs and a few alternative ways to renovate should be defined and verified the results for the needs and foreseeable incomes. Also user satisfaction after renovation should be into account. (Trivers 1999b, Interviews 2001)

4.4 Quality of technical life cycle management and services

The nature of technical life cycle services makes it difficult to purchase and evaluate them: they are knowledge intensive, intangible and not measurable straight after they are performed. Incorrect performance will be realised after a few years and then it may cause enormous costs and losses in income. In addition a qualified technical life cycle manager must be able to manage very wide, interdisciplinary and theoretical totality. (Koskelo 2000)

According to the interviews and literature the most important properties of service providers, excluding the price, are shown in figure 4. According to Lundström (Lundström, 1999) the quality of FM-services or service providers can be evaluated by using the following criteria: reliability, response time, competence, ability to improve competence (know how), accessibility, customer oriented service, communication skills, financial solidity, reputation and understanding of customer needs.

Requested quality of FM services/service providers	
FIN	D
<p>Quality of FM services:</p> <ul style="list-style-type: none"> •User satisfaction •Number of reclamations and reaction speed •Customer satisfaction •Competence •Innovativeness •Quality. 	<p>Quality of FM services:</p> <ul style="list-style-type: none"> •Ability to manage complex tasks •Speed
<p>Confidentiality:</p> <ul style="list-style-type: none"> •Co-operation experiences and reputation 	<p>Confidentiality:</p> <ul style="list-style-type: none"> •Confidential treatment of sensitive Business information and internal information
<p>Increase of property value:</p> <ul style="list-style-type: none"> •Cost effectiveness and correlation 	<p>Increase of property value:</p> <ul style="list-style-type: none"> •Securing of rental and Investment value •Increase in efficiency
<p>Trust:</p> <ul style="list-style-type: none"> •Specification of contract •Reliability •Documents, systems and products •Communication and information movement 	<p>Trust:</p> <ul style="list-style-type: none"> •Transparency of FM services and costs •Reliability
<p>Savings of costs:</p> <ul style="list-style-type: none"> •Cost effectiveness •Network management and co-ordination 	<p>Savings of staff:</p> <ul style="list-style-type: none"> •Reduction of staff
	<p>Savings of costs:</p> <ul style="list-style-type: none"> •Reduction of operational costs •Guarantee to reduce the number of technical knots

Figure 4: The most important selection criteria for real estate service providers. (Interviews 2000, Halder 1999)

Yet the real estate managers do not have tools for evaluating technical life cycle service providers. For example competence, quality and ability to manage complex tasks were considered as very important selection criteria but evaluating these kinds of properties was found impossible. Also for example the definition “what the competence means and who was competent enough for critical tasks” was not defined. It was either not defined what kind of competence should be expected and what is the critical know-how of the technical life cycle service provider (Koskelo 2000).

Generally the *technical life cycle services are outsourced* - all the complex tasks are bought from specialised service providers by own organisation. The best situation in purchasing technical life cycle concept would be to purchase the whole technical knowledge from the same service provider. It should be possible to buy different kinds of technical life cycle service packages. The services that are mostly needed should be included in the basic service packages and service providers should tailor the final service combinations according to customer needs (Koskelo 2000).

5 Summary

The main objectives of the interviews and the literature studies were to clarify: 1) Who is responsible – who should take care of the technical life cycle of the building? 2) Does the responsible party take care of it? Is it carried out in an adequate level? If not, why? Is the technical life cycle management considered as an important part in real estate business?

The owner organisation of the real estate is the party who is responsible for strategic technical life cycle management. It is the party that has invested on fixed assets, which should be taken care of. The asset value of a building, the measure of its value in financial term, is related to how the building is designed, constructed, operated and maintained.

Technical life cycle management has an effect on both users and owners of the real estates. For the users it is possible to offer healthy, safety, flexible work environments that strongly supports the primary objectives of the organisation and for the owners it has in a long sight a clear effect on net profit.

It essential to connect the strategic technical life cycle management to the decision making processes of the corporate real estate business.

Fixed assets are an important business factor. Strategic business planning should be done also in real estate business and the technical life cycle management is one of the most important things in decision making. However it is very common that long sight strategic planning is not done for technical life cycle of the buildings. There are numerous reasons for that:

- ?? Non-property companies generally, even if they own real estates, do not perceive their core competence to be in real estate business, therefore they do not define strategies for technical life cycle (management) of real estates or even for real estate management.
- ?? Corporate managers in many companies do not inform clearly enough the corporate mission and vision to real estate or facilities professionals, who hardly ever for example can “even quote the corporate mission statement or can outline their organisations three-or-five-year goals. Or are intimate with this years business plan”(Loch 2000).
- ?? Defining the vision, goals and strategies for technical aspects of the buildings is difficult, better methods of appraisal, analysis, prediction and planning for improving future decision making in real estate investment, development, management, marketing and valuation are needed.
- ?? There is not enough competence and no useful tools available for making strategic technical life cycle planning in real estate companies or real estate departments of non-property companies. Even the visions are rarely clear.
- ?? There is not enough competence or right kind of competence in technical life cycle service providers for providing competent services and service packages.
- ?? There are no tools for evaluating the service providers and their competence. Technical life cycle services are intangible, knowledge intensive and theoretical - and therefore - difficult to evaluate

and purchase. More efficient tools for purchasing and evaluating are needed, also tools for following the implementation are essential for real estate owners.

- ?? Real estate branch is interdisciplinary. This interdisciplinarity causes demanding qualification requirements for professionals. In addition the diverseness of the branch makes it difficult to define core business areas and essential points within the branch.
- ?? Generally, for the real estate companies the most important thing is to improve the ROI. The whole business is based on annual profit and thus the visions and strategies are more concentrated on yearly-plans. Proof of the profitability of long term technical life cycle managing is needed.

6 Discussion: conclusions and suggestions

Main phases of the technical life cycle of a building

Real property life cycle can be divided into a few main phases. It may be differentiated between a technical and economical useful life. From both of these perspectives, there are *critical phases in technical life cycle decision making*, where all the possible available information about technical life cycle of an existing building is needed and should be considered. The most important phases of **the technical life cycle** in broad outline are as follows:

1. **Development of a new building** => From an investment analysis phase till the auditing phase => For example the following definitions and analysis could be done:
 - ?? Defining the visions of the real estate, setting the goals, defining the use, users and the life cycles of utilisation.
 - ?? Define needed IAQ-levels in different parts of the building, the service life of the building and its structures: support and infill parts.
 - ?? Defining the image questions, needs for flexibility, alternative utilisation.
 - ?? Defining the risks connected to soil of the building ground, environmental circumstances, geographical environment, structural design decisions etc. Define the quality assurance tests needed in construction.
 - ?? Designing the instructions for maintaining and using the building and all the technical details of the building. The first renovation cycle should be pre-designed
 - ?? Defining the performance criteria of a real estate and defining the expectations connected to user satisfaction and net income.
2. **Auditing the new building** => Does the building correspond to the defined requirements and definitions and goals. Is there a planned relevant maintenance strategy. Are all the critical details connected to technical life cycle documented and taken into account in maintenance strategy. etc. In addition it is essential to supervise the implementation of the maintenance program during the use of the building.
3. **The performance of the real estate is not satisfactory anymore** => Decision of redevelopment, renovation, demolition or selling the real estate or just keep it as before => From a perspective of technical life cycle the tasks could be for example: Defining the residual value, defining the remaining service life of the different parts of the building: support and infill parts and technical systems etc. Inspection of alternative possibilities to use or renovate the building. Inspection of the risks and opportunities, costs and foreseeable benefits.
4. Selling/purchasing a real estate => **When making purchasing decisions the following technical life cycle aspects should be considered:** Define if there is information and documents available about the building which is for sale? Defining the residual value, remaining service life of the different parts of the building: support and infill parts and technical systems. Defining the

flexibility of the building. Inspection of alternative possibilities to use and renovate the building. Inspection of the risks and opportunities, costs and foreseeable benefits. How the building has been maintained, what were the visions and goals in investment analysis and construction phases for the building?. How the building has been used and who has been using it? What kind of processes has been carried out in the building that could have had an effect on the structures etc. What are the required costs during the next 5 and 10 years for refurbishing and maintaining the building? Is it possible to realise the vision and goals defined for the building in a cost-effective way?

In figure 5, the critical points of the technical life cycle decision making are presented.

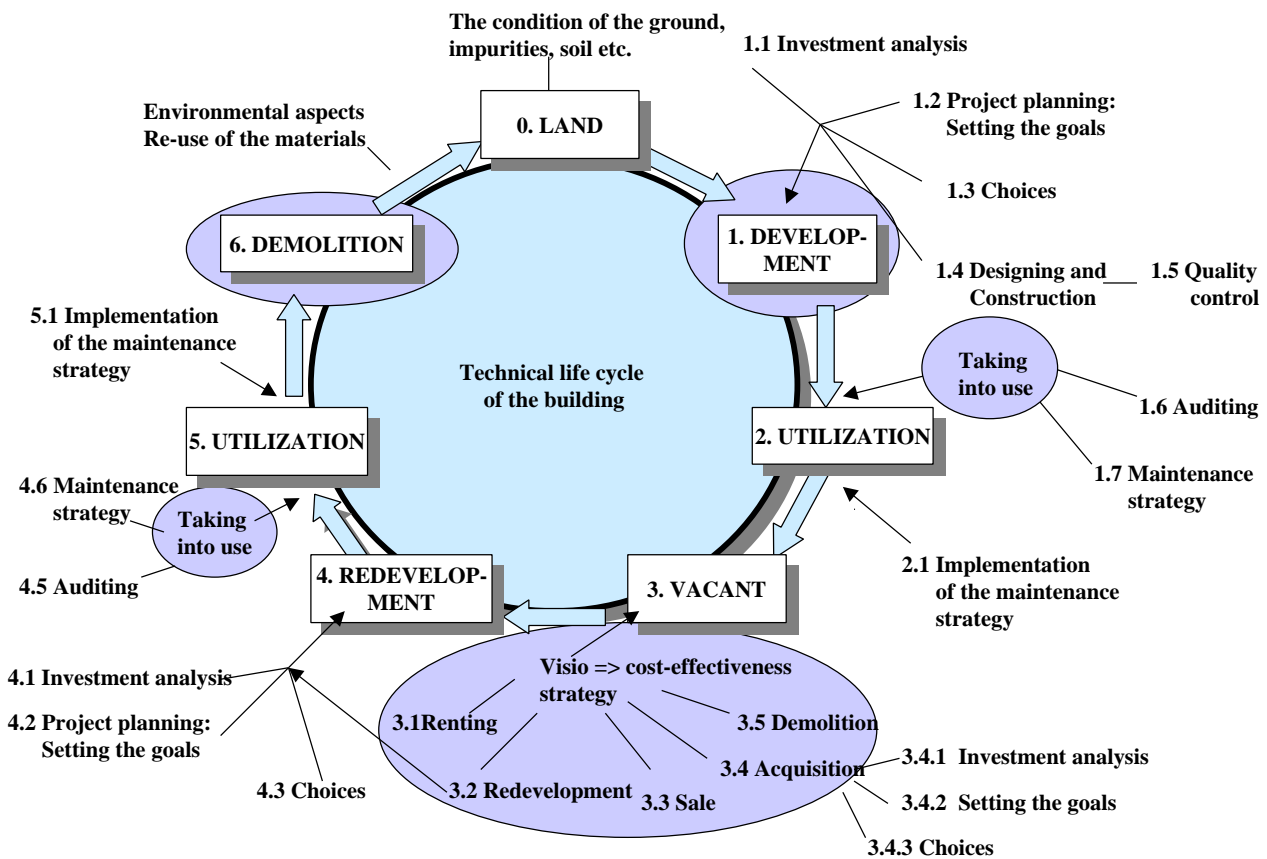


Figure 5. Critical phases of the technical life cycle management. 1) Development and defining the strategies 2) Auditing phase – taking into use 3) Strategic decision making points: redeveloping, renting, selling, demolition and acquisition-phases 4) new strategies 5) demolition decision. (TK 2001)

Characteristic features of Technical Life Cycle Concept:

- 1) Technical life cycle (TLC) concept should be a continuous and seamless, well documented managing and service concept from investment analysis phase till the demobilisation phase of a real estate. It must be defined according to the visions and goals of an owner organisation. Decisions connected to technical life cycle are a part of corporate real estate management.
- 2) Technical life cycle management and co-ordination of the technical life cycle is *more a process than a project*. It is a continuous co-operation relationship between the owner and the TLC-manager. The services can be outsourced if there is not enough competence in the owner organisation for creating technical life cycle strategies and manage their implementation in practice. The outsourcing decision depends on the competence and the structure of the owner

organisation. Technical life cycle consists of technical management of an entire life cycle of a real estate. By long term planning in the TLC-process it is possible to achieve a healthy, safe and economical building, which reflects the real value of a real estate.

- 3) The aim of *technical life cycle management* is to optimise the life cycle costs and the properties of the real estate, according to the real estate visions of the owners. The technical life cycle concept is a *strategy* for technical life cycle. The main role of the technical life cycle manager is to define a strategy for the technical life cycle according to owner goals and manage its implementation into practice. The service concept in investment analysis or project planning phase creates frames for technical possibilities to build economical, healthy and safe buildings.
- 4) The technical life cycle manager must be able to adapt theoretical know-how to practice - the technical life cycle decisions need wide theoretical understanding and experience. The managing services are knowledge intensive, intangible and interdisciplinary and need interaction between different technical life cycle project team members within a project. Services are connected to structural and building physical design decisions taken into account micro and macro environment of the building. Services are directed to the building itself. Well-performed life cycle service concept benefits both the owner and the user of the building.

In the next phase of the project “Purchase model of technical life cycle service concept“ the tasks of the technical life cycle manager in critical points will be specified. Also the tools for building technical life cycle strategies will be defined.

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