

Facility Management

Business Process Integration

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Abbreviations

| | |
|---------|---|
| ABAP | Advanced Business Application Programming |
| AD | access denied |
| AEC | Architecture, Engineering and Construction |
| ARIS | business process modeling tool ("ARchitecture of Integrated Information Systems") |
| AS-I | Actor Sensor Interface |
| ATGA | An Institute called „Akademie für technische Gebäudeausrüstung“ |
| BA | Building Automation (Systems) |
| (B)API | (Business) Application Programming Interface |
| BOR | Business Object Repository |
| ca. | circa |
| CAD | Computer-Aided Design |
| CAFM | Computer-Added Facility Management (Systems) |
| CO | Controlling |
| CREM | Corporate Real Estate Management |
| DB | data base |
| DIN | „Deutsche Industrie-Norm“ / German standard |
| DKM | “Digitale KatasterMappe” |
| DMS | Document Management System |
| DWG | DraWinG File |
| DXF | Drawing eXchange Format |
| e.g. | for example |
| EAI | Enterprise Application Integration (technologies) |
| EDM | Electronic Document Management Systems |
| EIB | European Installation Bus |
| ERP | Enterprise Resource Planing (Systems) |
| et.al. | and others („et alii“) / and elsewhere („et alibi“) |
| etc. | and so forth / and others („et cetera“) |
| f. | following |
| FI / TR | Financial Accounting |
| FM | Facility Management |
| FMA | Facility Management Austria |
| GEFMA | German Facility Management Association |
| GIS | Geographic Information System |
| GOA | „Gebührenordnung für Architekten“ |
| HNCP | Home Net Control Protocol |
| HOA | „Honorarordnung für Architekten“ |
| HOAI | „Honorarordnung der Architekten und Ingenieurkonsulenten“ |
| HOB | „Honorarordnung für Bauwesen“ |
| HO-PS | „Honorarordnung für Projektsteuerung“ |
| i.e. | that is („id est“) |
| IAI | International Alliance for Interoperability |
| IDoc | intermediate document |
| IFC | Industry Foundation Classes |
| IFMA | International Facility Management Association |
| ISO | International Organisation for Standardisation |
| IT | Information Technology |
| LON | Local Operating Network |
| EDI | electronic data interchange |
| MIS | Management Information Systems |
| NBP | „Nutzerbedarfsprogramm“ / program of user needs |
| ÖBA | „Örtliche Bauaufsicht“ / construction supervising |

| | |
|--------|--|
| ODBC | Open Database Connectivity |
| OLE | Object Linking and Embedding |
| OLTP | OnLine Transaction Processing |
| ON | „Österreichisches Normungsinstitut“ / Austrian Standards Institute |
| ÖNORM | „Österreichische Norm“ / Austrian Standard |
| p. | page(s) |
| PPH | project phases |
| PS | Project System |
| REM | Real Estate Management |
| RFC | Remote Function Call |
| ROI | Return on Investment |
| SQL | Structured Query Language |
| STEP | Standard for the Exchange of Product Model Data |
| TCP/IP | Transmission Control Protocol/Internet Protocol |
| TO | „Technische Oberleitung“ |
| UML | unified modelling language |

1. Introduction

Many publications and books refer to Facility Management (FM) as a new management strategy. (see [Braun 01] p. 3 f. or [Ghah 98] p. XIII, et.al.) According to experts it is capable of rapidly reducing common costs while at the same time significantly improving productivity.¹ Some years ago, most companies followed the simple strategy of putting the main focus on reducing the costs for supplying all facilities necessary to carry out the core business. (see [Died 99] p. 328) Initially only few enterprises were aware that a smart and efficient approach must consider both sides, the reduction of costs and the improvement of the output. Nowadays the major effort is rather put on the improvement of productivity, because the simple approach of cost reduction was found not to be efficient enough.

The starting point of this thesis is the examination of the current Facility Management situation. To this end a representative sample of international companies from various business fields was investigated with respect to their actual FM practice. In order to get a total view of the situation, FM consultants were interrogated about their present concepts, experience and orientation. The input of architects and construction companies was used to get an impression of today's possibilities in the field of FM. In order to verify the functionality of BA systems, suppliers of such systems were included in the thesis. Finally, this investigation allowed to abstract and to derive a general view of the actual situation and compare it with the actual status of research found in various publications.

Starting from this analysis and the requirements of the various people interrogated in the first step, a definition and concepts for efficient FM were derived. This was done on a functional basis in order to define the necessary FM business processes. The proven method „value analysis“ was used at this stage of setting up a concept for efficient FM. The result of the value analysis consists of an identification and specification of the FM processes, giving an overview of the different „fields“ of Facility *Services* and *Management*.

¹ „Productivity“ corresponds to the yield provided by the building / infrastructure see [Pir 98] p. 277.

There are two types of processes: the operative processes being carried out during the life cycle of the building called „Facility Services”, and the controlling and management processes called „Facility Management”. The difference between the existing operation of facilities and Facility Management mainly consists of:

- The focus on the management processes,
- the notification, consideration and co-ordination of the importance and needs of all phases of the life cycle and
- the integration and co-ordination of the different „services” of all phases of the life cycle, now being performed independently although they interfere on a high degree.

In a next step the analysis of the whole life cycle of the facilities was split in three parts:

- the conception, planning and construction phase,
- the utilisation phase including the renovation and refurbishment phases,
- the demolition phase.

An „integrated” process model for the *conception, planning and construction* processes of facilities is developed. This concept includes the integration of the processes of this phase into the whole life cycle for example by including the analysis of the investor’s, user’s and operator’s needs as a basis for the conception phase and the proper delivery of the facilities and the connected data into the utilisation phase. The concept also takes into consideration the co-operation between the architects, engineering consultants and the other planners. The process roles of key actors like architects, engineering consultants, planners, project managers and Facility Managers are also defined to secure a proper conception, planning, construction in accordance with the needs of the investor, user and the operator. This concept of roles guarantees the optimal usability during the rest of the life cycle.

The goal of the research within the *utilisation phase* was to find a concept for efficient IT process support during the utilisation phase of facilities. This includes two levels: the operative level represented by the reference models of operative FM processes during the utilisation phase, and the controlling level based on the data of the operative processes. The second level can only be determined when the operative processes and the underlying data structure have been defined.

This concept is based on standard reference models of the key FM processes during the utilisation phase and an analysis of the existing functionality of the relevant IT tools.

To gain a common reference model of the FM business processes during the *utilisation phase*, studies were carried out at several international companies. The key FM processes were modelled by applying the ARIS method to find out the common steps and differences. At a certain level of abstraction the steps of the processes within the different companies were quite common. As a result common process models for the key FM process were defined at an abstract level, sufficient for examination of possible IT support. This model covers roughly 75 percent of the FM processes.

In a next step, the relevant software tools were investigated and their functionality was reviewed with respect to their capability to provide efficient process support. As a result of the analysis it was found that the existing software packages were not satisfactory in that they only supported parts of the business processes. Continuous workflow support was not conceivable.

Therefore a concept of integration of the existing IT tools was developed. It specified the functionality of a tool that provides the necessary interaction and data exchange for supporting the previously missing parts of the workflow. An implementation of this theoretical concept will further on simply be called „Daemon“. The Daemon as a software solution for interaction and data communication between the engaged IT tools in FM was specified, designed, implemented and tested in practical use. The results encourage further developments in this field as this integrated software landscape is already capable of supporting a large range of the key FM processes.

Based on this integration unified objects were defined, combining the distributed information of the FM business objects. This results in a joint FM database structure. However, in addition to this data, standardisation must take place. To this purpose standardised data hierarchies for cost accounting and building related data were developed.

The support of the operative processes, the joint data structure and provisions for the standardisation of the data finally enable standardised calculation of benchmarks for controlling purposes. The usability of the whole concept was proven by the employment of the business data warehouse concept in a field test.

The subsequent chapters follow this approach, starting from a theoretical examination of the FM processes, a definition of FM and the „integrated” process model for the *conception, planning and construction* processes, followed by the requirements and tools for the *utilisation phase* and ending up with a powerful benchmark system for *Facility Management*.

Finally, the *demolition phase* at the end of the building live cycle and the related waste disposal management is of increasing influence on the whole life cycle and the cost structure. The requirements of the demolition phase and the implications of decisions within the other phases like the conception and planning phase on the *demolition phase* must always be considered.

2. Definition of FM

The significance of Facility Management (FM) has grown rapidly over the last years [Moslener 88]. This management strategy originally stems from America and has taken root in Europe via Great Britain and the Netherlands. (see [Died 99] p. 327)

As FM is interpreted and applied differently in various countries, different definitions arose as a consequence. In the USA the investment aspect of FM is more emphasised, whereas in Europe facility managers rather concentrate on operative processes. Therefore a wide variety of definitions of FM can be found in literature. (see [Schul 00] p. 34 f.; [Braun 01] p. 1 f.; et.al.)

- IFMA, the International Facility Management Association, has its headquarters in Houston and is a world wide organisation having close to 20,000 members in about 100 countries. There are national IFMA chapters e.g. in Austria, Germany and Switzerland. IFMA has formulated the following definition:²

„Facility Management is the practice of co-ordinating the physical workplace with the people and work of the organisation. It integrates the principles of business administration, architecture and the behavioural and engineering sciences.“

Characteristic for the American approach, FM shall be summed up to the three important „P's“, i.e. Place, People and Process. The last one represents the interaction between Place and People.³ (see [Schul 00] p. 35 f)

- GEFMA, the German Facility Management Association has issued several definitions, which generally are more technically orientated.⁴
- *„Facility Management ist die Koordination und Bereitstellung von Informationen für das Planen, Bauen und Nutzen von Immobilien, Gebäudebestand, Personal- und Sachleistungen.“*

² www.ifma.org/whatsfm/index.cfm?actionbig=9 (18.09.2002) also [Cotts 99].

³ This approach follows the established 4'Ps marketing concept, which has been accepted in theory and practice. The P's stand for „Price“, „Product“, „Promotion“ and „Place“. See [Wöhe 00] p. 516 ff.; [Kinnear 95] p. 32 f; [Meffert 98] p. 56 f; others.

⁴ www.gefma.de/Gefma/1024x768/index2.html (18.09.2002).

„FM ist die Gesamtheit aller Leistungen zur optimalen Nutzung der betrieblichen Infrastruktur auf der Grundlage einer ganzheitlichen Strategie.“⁵

This definition concentrates on information (data) and infrastructure. Its significance lies in the second part. There FM is defined as a strategy thus emphasising the comprehensive character of FM beyond uncoordinated operative handling without management. Unfortunately, the statement is not precise enough and thus is prone to misinterpretation.

- In the GEFMA 100 standard, another definition is published in ([GEFMA 100], p. 5., draft 12-96: „Facility Management, terms, structure, content“):⁶
- *„Facility Management ist die Betrachtung, Analyse und Optimierung aller kostenrelevanten Vorgänge rund um ein Gebäude, ein anderes bauliches Objekt oder eine im Unternehmen erbrachte (Dienst-)Leistung, die nicht zum Kerngeschäft gehört.“*

This definition has two major disadvantages:

- It is primarily cost orientated.
- It uses the term „core business” and defines FM as everything not belonging to the core business. The term core business is not very precise as it has no unique definition. For each company core business means something different.

Each of the last two definitions set-up up by German organisations emphasises only segments of FM. They concentrate on technical aspects and costs instead of understanding FM as a general management strategy.

- ATGA, an Austrian FM company, published a definition:⁷
- *„Unter Facility Management verstehen wir das Koordinieren aller Anlagen, Einrichtungen, Gebäude, die darin enthaltenen Arbeitsplätze, Grundstücke und die*

⁵ In English: „Facility Management means the co-ordination and provision of information for planning, building and using real estate, premises and technical and commercial services.“

„FM represents the sum of all efforts for optimum usage of the internal infrastructure on the basis of a comprehensive strategy.“

⁶ The GEFMA 100 definition in English: „Facility Management means survey, analysis and optimisation of all cost relevant processes related to a building, a facility or a service provided by the company, but not belonging to the core business.“

⁷ www.atga.com (18.09.2002) under „FM Glossar”.

dazugehörigen Infrastrukturen mit den Menschen und den Aufgaben des Unternehmens bzw. der Organisation.

- *Es nutzt Kenntnisse der Wirtschafts-, Ingenieur- und Verhaltenswissenschaften sowie aus Architektur und Design. Facility Management betreut mit seiner langfristigen Betrachtungsweise alle Gebäude, Anlagen und Einrichtungen über deren gesamte Nutzungsdauer.*⁸

This concept, which to a certain extent is similar to the IFMA definition, comprises economical, technical and social categories as well as the management function for co-ordination of tasks and facilities.

It also includes the life cycle idea, thus not only considering the optimisation of the construction of a building – a phase in which only 20 percent of the total costs of a building are spent – but rather the optimisation over the whole life cycle.

- A.-F. van Wagenberg published the following definition:

„Facility Management is a general management function, responsible for the facility as a result of planning and co-ordinating the support processes, aimed at the promotion of the success of the core process of the organisation.“

In this definition the management aspect of Facility Management is emphasised. FM is understood as closely related to the core business and shall actually ensure successful business. Therefore FM is not independent of the core business, it has to fulfil the needs of the core business. It is a result of planning and co-ordinating the support processes on the basis of the demands of the core functions.

⁸ The ATGA definition in English: „Facility Management means the co-ordination of all systems, inventory, buildings, the workplaces, properties and the related infrastructure together with the people and tasks of a company or organisation. It utilises knowledge of economics, engineering, and behavioural sciences, as well as of architecture and design. The long term concepts of Facility Management take care of all buildings, equipment and inventory for their whole life cycle.“

- The „Centre for Facilities Management of the Netherlands” stated the following definition.⁹ FM is:

„The process by which an organisation delivers and sustains a quality working environment and services to meet the organisation’s objectives at best cost.“

As the term core business can always lead to misunderstanding, this version states that FM has to sustain the quality of the working environment and puts an emphasis on the process orientation of Facility Management.

- NHS Estates, the British Department of Health, published the following definition.¹⁰ FM is:

„Comprehensive management of all facilities and associated services and resources which support the primary purpose of the organisation.“

Strictly speaking „associated services“ specifies any process which doesn’t belong to the core business, even e.g. human resource management, as belonging to FM.

The last definition aims at defining FM as a support function for the core business. However, in fact it is difficult to split core business and Facility Management, as for some companies, e.g. „Lufthansa Gebäudemanagement” and „Siemens Gebäudemanagement”, FM is their core business. These companies were split from their parent company for providing Facility Management for them and other companies.

The second definition goes even further by defining FM as an external component, in not considering it as an integral part of the own management, but rather as an outsourced service. This can lead to severe problems, if the job of co-ordination of the outsourced processes and matching the outsourced strategy with the strategic goals of the company is not fulfilled properly. Outsourcing cannot solve internal problems.

At least an experienced buyer must be available within the company to co-ordinate and translate the internal needs into facility services, to order the needed services at the proper

⁹ <http://www.fmn-vereniging.nl/overfmn/main.asp?pageID=2&menu=2> (27.09.2002).

¹⁰ www.nhsestates.gov.uk/facilities_management/index.asp (19.09.2002).

quality and price and to be *the* contact person for the service deliverers. This person also secures the proper delivery, the co-ordination of the deliverers and controls the budget.

Above examples show that some definitions reduce FM to the (computer based) administration of buildings, an interpretation which definitely is too slash. Others see human resource management included in FM.

These deviations in the specification of the actual scope of FM are due to the fact that up to date no international standard has been set up.

- The EuroFM¹¹, an European network for research, education and practitioner organisations, consisting of more than 70 member institutions, defined FM as follows:

„Facility Management is responsible for co-ordinating all efforts related to planning, designing and managing buildings and their systems, equipment and furniture to enhance the organisation’s ability to compete successfully in a rapidly changing world. So the highest quality of use and economy can be reached.“

This means:

- *responsible for co-ordinating all efforts*: FM is not (only) the operative activity, it is a management function.
- *all efforts*: It is – in fact should be – responsible for *all* efforts. One organisational unit must be in charge of and responsible for all FM related decisions as to avoid parallelism and to utilise synergies. In many fields there are two or more deviating possibilities: e.g. for maintenance it is possible to follow either the strategy of preventive maintenance or the strategy of no maintenance, the latter one, however, generates considerable call centre activity for handling trouble shooting. Only a single department in charge of all FM activities can specify a proper, efficient maintenance strategy, applied company-wide.
- *planning, designing and managing*: FM includes the whole life cycle of a facility. It should not be performed only in the utilisation phase.
- *buildings and their systems, equipment and furniture*: Not only buildings but all facilities are covered by the FM activities.

¹¹ www.eurofm.org/ (19.09.2002).

- *enhance the organisation's ability to compete successfully in a rapidly changing world:*
The main goal of FM is to support and optimise the core business activities. Therefore the core business determines the specific tasks of the internal or external FM.

However, even this definition is not precise enough for practical use. There are also other disadvantages of the present situation:

- Various, sometimes contradictory definitions can confuse the decision-taking unit, because there are no official guidelines.
- The deviating definitions of other chapters of the IFMA or the EuroFM are based on different laws and standards.

Therefore the Austrian standardisation organisation ON installed a standardisation group to define all necessary parts of FM. The group members initially had to overcome several difficulties:

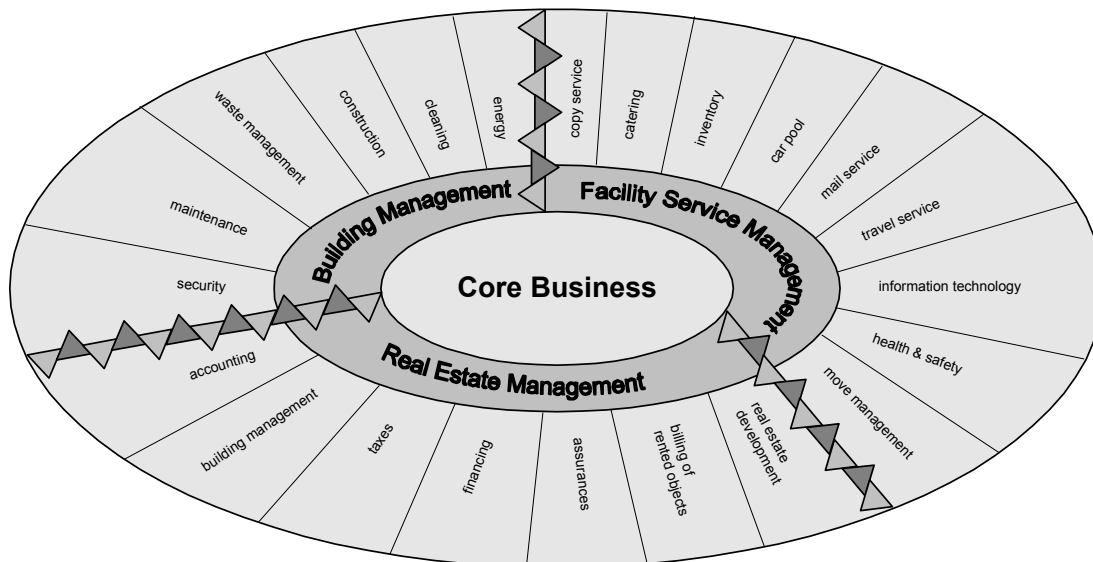
- The group originally was part of the *maintenance standardisation group*. This was due to the German speaking concept which looks at FM mainly as a technical subject. As maintenance is a major task to be carried out in the context of FM, the group was first allocated there.
- *Different positions* of the group members. The different sections (technical, economic, legal, ...) represented in the FM standardisation group each tried to push their own positions, which in some cases were not compatible with the maintenance headlines.
- *Own standardisation group FM*. As a result of the long ongoing debate an own standardisation group called „Fachnormenausschuss 240“ with new – interdisciplinary – heads was set up. Also the organisation of the group was adapted.
- *Core Business* as part of the standard. Core business is very difficult to integrate in the text of a standard because it depends on the specific enterprise under consideration. Therefore long debates took place on the verbal definition of FM as a support process for the „core business“.

Finally several provisional standards were drafted. The standard was decided to be preliminary as to allow for future updates in a field which is still subject to frequent changes.

The „VORNORM ÖNORM A 7000“ defines basic concepts and terms of Facility Management and is available in the version dating from 01.06.2000. It states:¹²

- „Facility Management ist ganzheitliches Management der Immobilien und der materiellen / immateriellen Infrastruktur einer Organisation mit dem Ziel der Verbesserung der Produktivität des Kerngeschäfts.“
- Facility Management ist ein interdisziplinärer Ansatz, der die Bereiche Technik, Ökonomie, Ökologie und Recht verbindet.“

The definition stresses the management functionality and covers not only real estate but the whole infrastructure. The main goals are support and improvement of the company's core business. (See figure 1)



Source: [ÖNORM A 7000]

Figure 1: Core Business and FM

In other parts of the standard the importance of the following two characteristics is outlined:

- FM applies to the whole life cycle.
- FM is process oriented.

¹² The ÖNORM definition in English: „Facility Management is the comprehensive management of real estate and material/immateral infrastructure of an organisation with the goal to improve the productivity of the core business. Facility Management is an interdisciplinary concept, which combines technology, economy, ecology and legal matters.“

The standard defines several other terms related to FM:

- *Workplace*
Workplace includes the working environment and its surroundings.
- *Cost-Benefit Analysis*
FM is not carried out for its own purpose. Cost reduction alone is not enough. All efforts / expenses for FM must be related to benefits in the core business.
- *Organisational Placement of FM*
The FM department must be allocated in the company so that it is granted the means required to fulfil its tasks within a holistic concept.
- *Service supplier*
Services can be supplied either by internal persons / departments or through outsourcing. Therefore, if a company performs all tasks with the help of external suppliers it must introduce the management of the external suppliers to be able to perform FM.
- *Facility Services*
Facility services are the operative parts of FM. When the services are carried out independently without integration and co-ordination, then this cannot be termed FM, because the nature of FM is the optimisation of workflow by utilisation of synergies and co-ordination of various services.
- *Methods and tools*
Supporting methods and tools like Computer Aided Facility Management (CAFM), benchmarking, outsourcing, help desk and service level agreements are listed here.

Several other standards complementing the basic FM standard „VORNORM ÖNORM A 7000“ are already defined or in preparation:

- Requisition catalogue for facility managers,
- Education within FM,
- Evaluation of FM services,
- Strategic FM,
- Functions of Facility Management.

The last standard was conceived, because there are still some major open issues like:

- Which consequences does the introduction of FM in a company have?

- Which processes are changed / affected by FM?
- How / to which extent is the internal company structure influenced by FM?

Answers to these questions could be found by defining Facility Management under observation of national laws and existing national and international standards. Such a definition must not be a solely verbal one which is too susceptible for misinterpretation and diverging reading. Therefore a functional definition of FM should be set up. This means FM is described by the functions that have to be carried out. To reach this goal, two steps have to be accomplished first:

1. By using the value analysis the functions have to be identified.
2. The functions have to be classified and a hierarchical structure must be generated.

After this a hierarchical function tree can be drawn up (see Figure 2: Function Tree). On the top level FM is found as the basic concept. The lower branches represent the various functions forming FM. Actually, not all branches necessarily need to be implemented in a company (see [Widhalm 99]). Therefore, compulsory functions and optional functions should be distinguished in the structure.

2.1. Method

The first step in setting up the FM function tree is a straight forward value analysis according to DIN 69910 and ÖNORM A 6750-6757. Such an analysis is an efficient way to optimise products and immaterial objects like processes and concepts. It was developed by General Electric at the end of the 40s as a tool for cost reduction. Since 1962 it is also used in Europe, with the goal to analyse and optimise structures of functions under the aspect of value increase. With this idea, it soon developed to a more powerful tool than a simple method for cost reduction. In this new form it can be applied for the quick and effective generation of new concepts, but also for the improvement of existing ones. (see [Lechner 01] p. 371 and especially [Coen 97] 479 f.)

The value analysis alone cannot grant an optimal solution, but its result will be very close to an optimum due to its inherent characteristics. The characteristics and their impact on the approach towards the definition of the FM function tree are described below: