

# Where does CAFM really help?

## Current fields of application and future trends according to system users

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**ABSTRACT:** The possibilities of CAFM systems are multifarious and the system manufacturers are constantly drawing attention to these. The question is, however, what do customers actually need and which functions are being used. Karlsruhe University (TH) has therefore conducted a survey in order to determine the current situation regarding CAFM installations and the future needs of users. A mail survey was chosen as the means of data acquisition. A sample group of more than 100 CAFM users were asked to complete a standardized questionnaire. This questionnaire comprises approximately 50 questions, including questions of a factual nature, questions relating to specific knowledge and appraisal questions. The results of the survey give an overview of the current fields of application for CAFM systems and a trend for future fields of application in terms of user needs. It also shows whether CAFM is primarily used by building owners, occupants or operators. The reasons for introducing CAFM systems become evident, as well as the extent to which these needs have been fulfilled. An overall evaluation of the systems draws attention to the deficits and strengths of CAFM systems.

## 1 INTRODUCTION

### 1.1 *What CAFM does*

The main purpose of a CAFM system is to support operational and strategic facility management, i.e. all of the activities associated with administrative, technical and infrastructural FM that arise when a building is in use, as well as the strategic processes. This support for areas of a business that are relevant to FM takes the form of documentation, provision and filtration of information and monitoring. The optimization of FM processes constitutes another purpose of CAFM. This support offers a means of reducing costs and making profits and is achieved against a background of operating expenses accounting for around 80 % of the overall costs of a building throughout its life cycle (design, planning, construction, use and realization). "Many building owners in Germany are still not sufficiently aware of the fact that 85 % of a building's life-cycle costs are incurred during the utility phase as a result of mortgage interest, rent, insurance, tax, energy, maintenance, repairs, running costs, cleaning or security services" GEFMA (2001).

### 1.2 *Fields of application for CAFM systems*

Nävy (2000) defines three fields of application. These were formed in order to enable better differentiation between the various applications. The first of these is the management-oriented field of application. "Management-oriented applications are the instruments for the organization, management and provision of information" [Nävy00 page 78]. As far as the management-oriented field of application is concerned, priority is given to the provision of information, which therefore constitutes the basis for the other fields of application.

The planning-oriented application supports planning activities by producing data and subsequently editing it specifically for the planning process that is relevant to CAFM. The editing function offers a means of evaluating planning alternatives. Priority is given to the performance of tasks for the procedure-oriented application which supports sequences of operations, procedures and processes.

### 1.3 *Benefits and objectives of CAFM systems*

The benefits and objectives can be divided into several main areas. One of these pursues functional objectives, i.e. using CAFM to achieve transparency of information, direct access to data and an improvement in planning performance and quality.

Another aims to fulfill economic objectives, i.e. reducing costs on a one-off and long-term basis, e.g. savings achieved as a result of user-specific accounting and maintaining the fabric of the building and its market value. A further area is concerned with legal objectives or, more specifically, adherence to statutory requirements, such as environmental legislation and the necessary documentation of compliance with these. There are also targets and objectives which cannot be clearly assigned to any of the aforementioned areas or are of a more general nature.

## 2 POSED PROBLEM

The documents provided by the manufacturers are very specifically tailored to their own systems and draw attention to the benefits that they offer. Manufacturers frequently boast a wide range of applications for their software, but there is as yet no overview of the actually used fields of application for CAFM systems. Neither is there any detailed information available concerning the scope of use of the systems in practice. This study examined existing CAFM installations in order to draw a comparison between claim and reality.

## 3 METHODS

The study was carried out with the help of a questionnaire. This method was chosen in order to be able to examine the largest possible number of installations.

### 3.1 *Questionnaire construction*

#### 3.1.1 *Requirements and objectives*

The purpose of the questionnaire was to examine the installations in terms of range of application, scope and benefits for the user. It should supply results which can be analyzed and compared. The same questionnaire was therefore sent out to all companies.

The main criteria for the formulation of the questionnaire were that the wording should be simple and concise and that the questions are easy to understand.

As no survey leader was available as a contact person to interview the respondents, the questions had to be formulated in clear terms and enable unambiguous interpretation. Misunderstandings could otherwise falsify the results under certain circumstances. Furthermore, there is a brief introduction at the beginning of the questionnaire, containing instructions on how to complete it.

### 3.1.2 *Scope*

The scope of the questionnaire was restricted to five pages so that the respondents did not need to spend too much time completing it and would therefore be more willing to do so. Five pages make a good compromise between obtaining information and reasonable amount of effort.

The questionnaire was accompanied by a document that included information on the background and the scope of the study. This made it possible to restrict the cover letter to just one page, again reducing the time required by the target person. Although the respondent could read the accompanying document, it was not essential in order to complete the questionnaire.

### 3.1.3 *Making contact*

As the manufacturers were unable to give us the names of contacts for certain reference customers, difficulties were encountered in locating the responsible members of staff within the companies concerned. A single-stage contacting procedure was planned for the survey, i.e. a letter was sent to each reference company directly and the questionnaire was enclosed with the letter. The disadvantage of this course of action is that there is no way of knowing exactly who has completed the questionnaire. A two-stage contacting procedure was out of the question because of the limited time available.

### 3.1.4 *Pilot study*

A pilot study offers a means of identifying errors in the questionnaire before it is sent out. These may take the form of systematic errors of reasoning, formulation errors or simple spelling mistakes. As far as this study is concerned, a pilot study was carried out within the bounds of possibility, i.e. the questionnaire was discussed and subsequently proof-read by two people from the IT and FM sectors who were known to the author.

### 3.1.5 *Formulation of the questions*

The questionnaire comprises questions of a factual nature, questions relating to specific knowledge and appraisal questions. Questions required both open and closed answers, as well as a combination of both. The open questions required an answer formulated by the respondent himself, whereas the closed questions offered the respondent a choice of alternative, pre-formulated replies (multiple choice).

### 3.1.6 *Anonymity*

The reference customers were assured that the data would be analyzed anonymously and in confidence to ensure compliance with data protection requirements and to dispel any doubts that they may have had. Anonymity had already been assured in

the cover letter. We deliberately avoided repeating this assurance too often, however, as an exaggeration may possibly have given rise to reservations.

### 3.1.7 *Layout*

Attempts were made to achieve a plain, uniform layout for the documents. The logos of Karlsruhe University and the Institute for Technology and Management in Construction (TMB) were used on the cover letter to reinforce the impression of "respectability" and underline the origin and academic purpose of the questionnaire.

The questionnaire, the cover letter and the attachment were printed on white paper of DIN A4 format. The chosen font was 10-point Arial with 1.5 line spacing and center justification.

## 3.2 *Topics covered by the questions*

### 3.2.1 *Working environment for the CAFM systems*

The aim was to acquire data that would permit an analysis of the installed software systems, with the system itself and associated boundary conditions in the foreground. The questions asked for details of the software used and the pertinent line of business, as well as data concerning the company itself.

### 3.2.2 *Range of application for the CAFM software*

Many different users and departments give rise to a very broad diversity of data and utilization. It is therefore important to know the working environment and the way in which the software is used in order to be able to make an assessment. Furthermore, under certain circumstances, the same performance is demanded of a system by different companies in the same line of business. This also offered a means of assessing the systems from several manufacturers. As facility management provides for a holistic examination, the life-cycle phase in which the CAFM systems were used was taken into consideration here as well.

### 3.2.3 *Fields of application for the CAFM software*

Although almost all systems offer the complete range of functions required for technical, infrastructural and administrative facility management, the functions actually used in practice constitute an unknown factor. An attempt was made to determine which of the various functions are actually used and in which fields of application.

### 3.2.4 *Installation characterization*

The questions asked for details of the point-in-time managed area with proportions in percent and the number of individual buildings to be managed to enable an assessment of the size and characteristics of an installation. They also asked about the number

of employees and budgets, whereby it was assumed that these questions would not be answered in full, if at all.

A knowledge of whether a company has an integrated building services management system, an interfaced business administration system or intranet integration makes it possible to determine the extent to which the system is being used within the company.

### 3.2.5 *Pursued objectives and effects*

The intention was to reach a conclusion regarding the achievement of pursued objectives. It is difficult to gain information on individual objectives with a single questionnaire that is identical for all respondents, which means that some very interesting answers were given in the "Other" section. The pursued objectives and effects were divided into the following sections: "General objectives and effects", "Functional objectives and effects", "Economic objectives and effects" and "Legal objectives and effects".

### 3.2.6 *Study of the costs*

Statements concerning actual costs incurred, their apportionment in percent and cost savings proved to be interesting here. This data can be used to calculate characteristic values, which may prove useful when planning a new installation.

### 3.2.7 *Assessment of the installation*

Questions related to user satisfaction and the quality of the installation were in the foreground. This part of the questionnaire asks the user for a purely subjective appraisal in an effort to discover improvement potential for the software.

## 3.3 *Sample group*

Letters were sent out to the selected 106 users of CAFM software for data sampling. These users were selected on the basis of research conducted with CAFM suppliers, who give details of reference installations on their web sites and on the basis of research in various FM journals, looking for progress reports relating to the operation or installation of CAFM.

Of the 106 companies who were asked to participate, 22 completed and returned the questionnaire. This corresponds to a response rate of 21 %.

## 4 RESULTS

### 4.1 *Working environment*

As far as the lines of business were concerned, the companies were distributed over a very wide range (refer to Table 1), which ensures that the results

were not affected by predominantly sector-specific influences.

Table 1: Lines of business for the responses

Line of business	Percentage
Financial services	18.2 %
Real estate service providers / FM	18.2 %
Industry	13.6 %
Municipal and local authorities	13.6 %
Trade fair companies	4.5 %
Energy suppliers	4.5 %
Clinics	9.1 %
Federal states' authorities and organizations	9.1 %
Media and communications	4.5 %
Education	4.5 %

#### 4.1.1 Databases

Of the databases used, Oracle proved to be the most dominant. Nävy (2000) ascribes a market share to the various database systems on the basis of the number of systems available on the market. This way of looking at the situation does not make any allowance for the frequency of each type of installation. A comparison with the results of the survey (refer to Table 2) shows that the dominance of the market leader database systems is even more pronounced when the number of installations is taken into consideration.

Table 2: Used database systems

Database	Percentage – Nävy	Percentage – survey
Oracle	47.1 %	63.6 %
Access	14.7 %	18.2 %
Fox Pro	5.9 %	9.1 %
ObjectStore	5.9 %	0.0 %
Sybase	5.9 %	0.0 %
Other	20.6 %	9.1 %

#### 4.1.2 CAD system

There was no clearly defined trend noticeable among the CAD systems used. Apart from AutoCAD and Microstation which are the dominant systems for pure CAD applications, the products of smaller businesses are also used in the CAFM sector (refer to Table 3). This is probably due to the fact that these products are more reasonably priced and are primarily used during the utility phase. Considerably fewer CAD drawings are produced during the utility phase of a building and, as a result, the software products of smaller, less well-known manufacturers also provide solutions which are technically adequate and are therefore suitable for use.

A comparison between the results of the survey and the reference literature confirms the results of the survey in this respect. AutoCAD has adopted a leading position in the market of CAD systems for CAFM.

Table 3: Used CAD system

Line of business	Percentage
AutoCAD	45.5 %
Condor	13.6 %
Atlantis	9.1 %
Microstation	4.5 %
Spirit	4.5 %
Nemetscheck	4.5 %
Other	18.2 %

#### 4.2 Range of application

In an effort to obtain an overview of the main applications, an index was developed which allows for 0.75 weighting for applications already in use and 0.25 weighting for applications that are currently in the planning stage. The index is standardized to a value of 1, whereby 1 indicates maximum utilization of the function. Table 5 shows the results for this index. Table 4 shows the distribution of applications already being supported by the CAFM system and those for which the implementation of support is planned.

As far as the reference installations are concerned, the main fields of CAFM application relate to infra-structural facility management. This is made evident by the two individual areas of "room book" and "strategic room planning". These applications are in use at virtually all of the examined installations.

The main fields of application that have emerged with respect to the examined installations can be clearly correlated with Nävy's definitions of the fields of application. These were formed by Nävy (2000) in order to enable better differentiation and typification of the various applications.

This is a predominantly management-oriented field of application, which constitutes the basis for the other fields of application. The reference customers' main fields of application correspond exactly to the core of the management-oriented field of application, which means that CAFM is primarily used as an instrument for the organization, management and provision of information.

#### 4.3 Pursued objectives and effects

On the whole, it is true to say that the objectives and effects reflect the main fields of application, i.e. functional aspects are in the foreground.

More than 70 % (refer to Table 6) of the respondents are of the opinion that FM processes have been improved by means of CAFM. This is frequently due to the fact that processes are not defined properly until they are documented. This alone brings about a considerable improvement, but the success can only be attributed to CAFM secondarily. However, most respondents did not believe that they had been able to conserve resources as a result of im-

plementing CAFM, but this had not been a primary objective for many reference customers, anyway.

Table 4: Range of CAFM application

Range of application	in use	use planned	total
Area and room management	86 %	14 %	100 %
Room book, strategic room planning	68 %	9 %	77 %
Cleaning management	50 %	23 %	73 %
Contract management	50 %	9 %	59 %
Fault management	45 %	23 %	68 %
Relocation management	45 %	23 %	68 %
Preventive maintenance management	41 %	27 %	68 %
Services on outside installations	36 %	9 %	45 %
Caretaker services / help desk	36 %	23 %	59 %
Cost accounting / controlling	36 %	23 %	59 %
Safety and security management	32 %	9 %	41 %
Cost management	32 %	27 %	59 %
Fire protection	27 %	9 %	36 %
House and apartment management (incidental charges etc.)	27 %	27 %	55 %
Order management / tender, order placement, accounting	27 %	23 %	50 %
Building services management system / building automation	23 %	23 %	45 %
Disposal	23 %	14 %	36 %
Energy management	18 %	18 %	36 %
Safety and security technology	18 %	9 %	27 %
Personnel management	14 %	5 %	18 %
Network / cable management	5 %	27 %	32 %
Canteen / catering	0 %	0 %	0 %

A large number of the functional objectives and effects had been achieved. This agrees with the main fields of application because the infrastructural functions offering functional benefits are most in demand. A deviation is evident with respect to the issue of "planning quality", however. A large number of reference customers stated that they had not been able to meet this objective. That means that the reference customers found that an improvement in planning quality was less easy to achieve with CAFM than the other objectives.

Economic objectives and effects were pursued and achieved to a lesser extent than functional objectives and effects. Only 13,6% of the reference customers had been able to reduce investment costs as a result of using CAFM and this would therefore appear to be generally difficult to achieve. Around 50 % of the respondents had been able to improve cost transparency.

A large number of the installations did not pursue legal objectives or effects and very little importance was attached to this aspect as far as the installations were concerned.

Table 5: Index of the ranges of application

Range of application	Index
Area and room management	0.68
Room book, strategic room planning	0.53
Cleaning management	0.43
Relocation management	0.40
Fault management	0.40
Contract management	0.40
Preventive maintenance management	0.38
Caretaker services / help desk	0.33
Cost accounting / controlling	0.33
Cost management	0.31
Services on outside installations	0.30
House and apartment management (incidental charges etc.)	0.27
Safety and security management	0.26
Order management / tender, order placement, accounting	0.26
Fire protection	0.23
Building services management system / building automation	0.23
Disposal	0.20
Energy management	0.18
Safety and security technology	0.16
Personnel management	0.11
Network / cable management	0.10
Canteen / catering	0.00

Table 6: Objectives and effects

Objective / Effect	Was not pursued	Was pursued	Was achieved
More transparent information	0.0%	18.2%	81.8%
Improvement of FM processes	4.5%	18.2%	77.3%
More effective information management	0.0%	27.3%	72.7%
No redundant data entries	0.0%	22.7%	72.7%
No redundant data storage	0.0%	31.8%	68.2%
Clearly defined areas of responsibility	22.7%	9.1%	50.0%
Faster planning	18.2%	22.7%	50.0%
Better cost transparency	9.1%	36.4%	45.5%
Better planning quality	22.7%	31.8%	45.5%
Cost reduction through process optimization and its consequences	9.1%	45.5%	40.9%
Customer-oriented accounting	40.9%	13.6%	31.8%
Conservation of resources	9.1%	54.5%	31.8%
Adherence to statutory requirements	36.4%	36.4%	27.3%
Reduction of planning costs	36.4%	31.8%	22.7%
Economical optimization of planning decisions	27.3%	45.5%	22.7%
Reduction of investment costs	40.9%	31.8%	13.6%

In an effort to evaluate the success rate for the achievement of pursued objectives and effects, quotients were calculated which reflect the respective

probability (refer to Table 7). The quotient is calculated from the values for the objectives that were achieved and not achieved. The pursued objectives and effects with the highest success rates are those relating to the provision and management of data. This, however, is due to the nature of the system.

Table 7: Success rate for the pursued objectives

Objective	Success rate
Clearly defined areas of responsibility	84.6 %
More transparent information	81.8 %
Improvement of FM processes	81.0 %
No redundant data entries	76.2 %
More effective information management	72.7 %
Customer-oriented accounting	70.0 %
Faster planning	68.8 %
No redundant data storage	68.2 %
Better planning quality	58.8 %
Better cost transparency	55.6 %
Cost reduction through process optimization and its consequences	47.4 %
Adherence to statutory requirements	42.9 %
Reduction of planning costs	41.7 %
Conservation of resources	36.8 %
Economical optimization of planning decisions	33.3 %
<b>Reduction of investment costs</b>	30.0 %
Mean value	59.4 %

#### 4.4 Study of the costs

The costs of implementation are determined to a great extent by the scope of functions, existing data, the number of workplaces and the fields of application (e.g. other, more detailed data is required for technical applications). The absolute implementation costs for a complete system amount to € 170,000 on average. Nine of the questionnaires were excluded from the assessment of implementation costs as the operators did not enter any information in response to the question. This means that the database is different. The scatter band varies between € 35,000 and € 500,000 and the range of the results amounts to € 465,000.

The average implementation costs for one CAFM workplace therefore amount to around € 4,300. It must be stated at this point that there is no linear characteristic for the implementation costs as a function of the number of workplaces. Disproportionately high costs are incurred by the first workplace, e.g. for data acquisition and the EDP structures.

As the informative content of a global statement regarding implementation costs is limited, the implementation costs were put in relation to the managed area. In addition to this, the number of fields of application used within the framework of each installation was also taken into consideration. In this

context, it makes sense to allow for the number of fields of application, as an increase in the number of applications necessitates a greater volume of data, possibly with a greater degree of detail, thereby incurring higher costs.

It did not appear expedient to break the fields of application down into any greater detail so this was not done. Examples of individual fields of application include cleaning management, room book and maintenance management.

The implementation costs for a CAFM system can be estimated on the basis of the calculated characteristic values. This can be done by simply basing the calculation on the gross area in m<sup>2</sup>, allowing for a mean value of 8,375 fields of application used. In this case, the costs of implementation amount to € 1.70 per m<sup>2</sup>. Alternatively, the implementation costs can be estimated on the basis of the gross area in m<sup>2</sup> and the number of fields of application used. In this case, the costs amount to € 0.28 per function and m<sup>2</sup>.

The implementation costs for CAFM solutions are made up of various parts. Nävy (2000) and Warner (1999) break the costs down in a virtually identical manner. Both sources state that the largest proportion of the costs are incurred by data acquisition (42 % and 37 %). According to Warner (2001), data acquisition accounts for 41 % of the costs. Warner's compilation [Warner01] is based on information gathered from 16 projects, whereby the statement from 1999 was taken from information supplied by the manufacturers. As far as Nävy (2000) is concerned, no details are given regarding the sources of the published results.

The results of the survey indicate a pronounced deviation from the values quoted by Nävy (2000) with respect to the costs of software and data acquisition (refer to Table 8). It appears as though the percentages for "data acquisition" and "software" have been swapped over. Attention must be given to the fact that the costs of data acquisition are affected by several parameters. The existing volume of data and its quality is one decisive factor; another critical criterion for the costs of data acquisition is the degree of detail of the requisite data.

Table 8: Costs proportionate to implementation costs

Cost segment	Percentage according to Nävy	Percentage according to results of survey
Hardware	10 %	6 %
Software	20 %	45 %
Data acquisition	50 %	19 %
Other	---	3 %
Training	5 %	9 %
Consulting	10 %	9 %
Software adaptation	5 %	8 %

The results of the survey do produce a remarkable statement in terms of the software costs. These ac-

count for 45 % in the survey, which is more than double the percentage quoted by N avy (20 % N avy (2000).

#### 4.5 User assessment of the installation

The reference customers were assured that the data would be analyzed anonymously in order to obtain the most objective result possible. When studying the completed questionnaires, it became evident that some users had certainly adopted a critical attitude with respect to the system. There was no way of checking the quality of the answers.

Users were asked to assess the system according to the grading concept used in German schools, which ranges from 1 (very good) to 6 (inadequate).

The response to "Usefulness of manuals" stands out against the other questions in a very negative manner. With an average grade of 3.17, this issue was regarded as definitely being in need of improvement. The other grades vary between 2.72 and 1.80, forming a tightly packed zone around the arithmetic mean value of 2.31. The result of the assessment is given in Table 9.

Table 9: Assessment of installation

Criteria	Note
Stability	1,80
Speed	2,25
Online help	2,47
Support by manufacturer during installation	1,95
Support by manufacturer during operation	2,11
Support by manufacturer for further development	2,37
Usefulness of manuals	3,17
User-friendliness of overall system	2,20
Functionality of overall system	2,10
User acceptance	2,50
Support of FM-processes in daily business	2,35
Feasibility of individual customization	2,20
Reporting of existing data	2,35
Assessment of cost-value ratio	2,72
Overall assessment of system	2,15
Mean value	2,31

## 5 SUMMARY AND OUTLOOK

Interesting results concerning the use of CAFM in practice were obtained within the course of the empirical analysis of CAFM installations described here. The results are not associated with any particular manufacturer and therefore stand out against data obtained from other sources.

Fundamentally important conclusions based on an analysis of the completed questionnaires:

- In practice, the main application of CAFM is found in the infrastructural segment. The technical and administrative segments are used to a lesser extent.

- CAFM is currently not being used as a tool for a holistic study of buildings. The objectives and effects pursued by the users are predominantly found in the infrastructural segment.
- CAFM is used almost exclusively during the utility phase. CAFM is not being used to study the buildings throughout the entire life cycle.
- Software and data acquisition account for almost 70 % of the CAFM implementation costs.

A typical CAFM system is employed in the infrastructural FM segment during the utility phase and is essentially used for organization purposes and for the acquisition and management of information.

The survey was only able to produce a certain amount of information regarding costs and savings associated with CAFM. The subject of costs is too sensitive to achieve a sound information base by means of a written survey. It is also possible that the requested information concerning costs is not available to the operators of the installations.

## REFERENCES

- N avy, J. 2000. *Facility Management : Grundlagen, Computerunterst utzung, Einf uhrungsstrategie, Praxisbeispiele*. Springer Verlag Berlin Heidelberg.
- GEFMA 2001. *Gefma, Deutscher Verband f ur Facility Management e.V., www.gefma.de*.
- Warner T. 1999. *Rechnergest utzte Systeme im Facility Management, Markt bersicht 1999/2000*. EBERT-Ingenieure N urnberg.
- Warner T. 2001. *Rechnergest utzte Systeme im Facility Management, Markt bersicht 2001*. EBERT-Ingenieure N urnberg.