# Multimedia Product Documentation - User Requirements

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*Abstract* – **The globalisation of industry and the strong dependence of the German machine manufacturers on export has increased the importance of an up-to-date and user-oriented product documentation not only as a cost factor but as a competition factor of strategic importance as well. The use of Multimedia is a promising approach to realize such an improved documentation. This paper presents the results of a survey that was conducted among the manufacturers of machines and their customers to identify the user requirements for Multimedia Product Documentation. As a result of the analysis a number of success factors are identified. Finally some recommendations for the implementation of a Multimedia Machine Information System are given.**

## I. INTRODUCTION

In recent years technical documentation and in particular product documentation has become a major issue for the German machine building industry. With the steady increase in machine complexity the need for more elaborate and user oriented documentation has also grown. On the other hand the new media have opened additional ways of publishing. Advanced many facetted possibilities are enabling new and improved means for content representation. Using electronic media (e. g. CD-ROM) for the delivery of product documentation it is now possible to include multimedia elements. It is expected that this will considerably improve the acceptance and usability of technical documentation.

Within the framework of the research project mumasy (multimedia machine information system) supported by the German Federal Ministry of Economy and Technology a consortium of industrial firms and research organisations is currently developing a set of concepts and tools for the efficient production of multimedia technical documentation [10]. In a first phase of the project the Fraunhofer Institute for Systems and Innovation Research has investigated and analysed the user requirements for multimedia elements in technical documentation. This paper will present some of the results of this research. A more complete documentation of the results can be found in [3].

## II. STATE OF THE ART

Today product documentation of the German machine building industry is almost always produced and delivered as printed matter. An analysis of more than 20 enterprises within the branch [4] has shown that although most of the firms are already producing at least part of their product documentation as electronic versions on CD-ROM, the basic and mandatory documents accompanying their machines are paper versions. This is one of the main reasons that multimedia elements are currently almost never included in technical documentation. Other barriers to multimedia technical documentations are lack of know-how on how to produce multimedia documents and the rather outdated methods and structures used in the production process of technical documentation [1, 5]. Only a small number firms are currently planning or implementing electronic editing and/or content management systems. In many cases standard word processing or DTP software are used for generating the document pages. Only a small number of larger firms are utilising document structures like SGML or lately also XML and are thus in a position to comfortably publish their technical documentation on various output media [8].

There are some indications, however, that in the future multimedia will become a significant part of product documentation. More and more firms are starting to believe that the inclusion of multimedia elements in their documentation will enhance the market chances of their machines and plants. Already today some of the machine building firms are using animated sequences and short videos to illustrate the functioning of their complex products. This idea will most certainly also be transported to the product documentation. It is commonly understood that the analysis of malfunctioning and machine breakdowns will be greatly enhanced and speeded up using visual means. This will result in reduced machine down-time, increased productivity, and increased customer satisfaction [7, 9].

A great deal of effort has been spent on analysing and designing product documentation to meet ergonomic requirements. The layout of documents has certainly improved over the last years. Readability and easier navigation together with an increased use of diagrams and pictures have improved the usability. However, although many firms believe that they are aware of what their customers (and users of their product documentation) need, little work has actually been done to determine the user requirements of product documentation.

## III. SURVEY DESIGN

The field exploration was conducted in 20 firms of the machine building industry and their customers. Altogether more than 50 users have been personally interviewed. The contacts to the customer firms were initiated by the supplier firms. Users from different departments and of various job requirements were asked about their experience with product documentation as well as their ideas on how documents should be improved in particular through the inclusion of multimedia elements. The main categories of users interviewed are: service managers, service technicians (both at producer and

customer sites), foremen, skilled workers (machines operators, electricians, mechanics), and unskilled labour.

The main goals of the field exploration were:
- To determine the current use and intensity of use of today's product documentation,
- to examine the potential of multimedia electronic documentation,
- to obtain an assessment of the product documentation available today,
- and to identify the requirements and demands of the customers and users of product documentation.

It was also hoped that the exploration would produce an indication as to the actual need and potential use of multimedia in product documentation and how this new form of documents could actually be implemented for use at the various production sites. An integrated approach was used looking at the need for multimedia as a whole and determining the overall requirements with respect to being part of technical documentation.

In order to obtain comparative results, interview guidelines were developed and consequently used during the interview phase. To account for the various interview partners a different set of guidelines was developed for each target group.

## IV. SURVEY RESULTS

The results of the field exploration have been categorized into five areas: actual use of the product documentation, assessment of the existing documentation, requirements for multimedia, most wanted features, and user environment i.e. conditions at the user site. It should be kept in mind that the use of product documentation accompanying machines and plants depends to a large part on the type of know-how and the experience of its potential users. Thus the responses obtained from the interviewed persons have differed accordingly.

### A. Actual Use of Product Documentation

The available product documentation is hardly used for regular work. Really intensive use takes place most of all during the introductory phase of a new machine. This is the time when it is important to become familiar with the technology in order to start productive work as soon as possible. A similar condition exists when a new worker is introduced to the machine. Product documentation is also used to obtain support during activities which only arise infrequently and are not part of the routine work to be done at or on a machine or plant.

Within the life span of a machine (often 25 – 30 years or more) it is not unusual to modernise, replace parts or modify the system in some way. To do this detailed technical information about the current state of the system and its components are needed. The only available source is generally the product documentation. Unfortunately after many years of use this documentation is often not up-to-date or parts are missing.

Part of the product documentation (especially parts catalogues) are needed for ordering replacements. In case of old machines it quite often happens that these catalogues are outdated or incomplete which can lead to problems during the ordering process.

With the delivery of new machines and systems the manufacturer normally includes detailed maintenance instructions. The specified intervals and the prescribed work is usually quite time consuming and costly for the customer. Thus he will develop his own service rules and maintenance schedule using as basis the supplier's specifications.

The *principal users* of product documentation are the service technicians. They could either belong to the customer's workforce or be part of the service team of the supplier. Service managers and sales engineers of distributors also make frequent use of technical documents.

The *intensity of document usage* varies considerably. As already pointed out during the first few months after the installation of a new machine the documentation will be used quite frequently. The need to consult documentation decreases rapidly as know-how and experience in operating a machine increases. Complex system will generally imply a longer period of familiarisation and thus a prolonged use of the documentation. The same is true for machines that require frequent adjustments.

The immense size product documentation can take on often is a barrier to its frequent use. Product documentation consisting of many folders and thousands of page are difficult to transport by servicemen and are many times kept out of reach at the customers site. Often lacking an efficient orientation aid also impedes users from accessing the documentation frequently.

### B. Assessment of Existing Product Documentation

As already indicated by the deficits mentioned above the response of users to question about usefulness of the available product documentation is in general not very positive. However, there has been an improvement over the last few years. Mainly with the addition of more and better illustrations such as drawings, graphics and pictures the readability and usability has improved. For some products the documentation was rated as good.

Product documentation was criticised on a number of points. The following were among the most often mentioned:
- Product documentation is believed as being to voluminous. As mentioned above this makes it more difficult to use. "A thick book is not being read!"
- Common experience shows that it takes too long to localise a desired information.
- Today's product documentation often lacks actuality. Changes in components or updates are often not included in the paper based documents.
- Especially with older machines the lack of proper documents is critical as it greatly increases the difficulty in making changes or localising breakdown causes.
- Faulty and outdated parts catalogues range high on the list of complaints.
- Users also criticise that today's product documentation is not designed for use by user groups with different needs (e. g. the requirements of a skilled or unskilled machine operator vary considerably).

- Product documentation continues to emphasize design, structure, and components and very often neglects the machine functions. In contrast to this users would like to know more about how a machine is functioning.
- There is a lack of detailed drawings and illustrations which would improve the understanding of systems especially for less skilled workers.

*C. Requirements for Multimedia*

The introduction of electronic documentation is generally considered an improvement. However, users continue to rely on a paper based product documentation and in most cases would not accept electronic documentation alone. One of the main reasons stated for this attitude is the easier use of paper based drawings of circuit layouts etc.. It is easier to take a piece of paper along when looking for a trouble spot underneath a large machine than a laptop computer. Another argument for paper documents was the simple way of marking certain spots or noting changes.

In the near future electronic documentation is expected to mainly supplement the printed version. It is not believed that today's paper based product documentation will be completely replaced. A major advantage of electronic documents is its compact size. This is especially attractive for service technicians to take along. Today a serious problem for servicemen is that they rarely have all the needed documentation with them when they visit a customer. A lack of the required information at the customer's site worsens the situation. As a result additional time has to be spent in troubleshooting and fixing the problem.

The best way to make product documentation available at the machine is still being discussed. Some would like to have the entire documentation available on-line i.e. it should reside on an Internet server for access from anywhere at any time. This would have the additional advantage that the documentation could be kept up-to-date in one database. Others would prefer to have the basic documentation on CD-ROM with Internet access to the newest information and most recent changes. In both cases it would be necessary to have access to the Internet on location. Today this is not always the case. As an example consider trouble shooting road construction equipment which is in use at a remote construction site. In this case Internet connection would only be possible via mobile communication. With UMTS or other high speed mobile services this might be a practical solution. It is also a question of display capacity. Only large, mainly stationary and complex modern machines are increasingly being controlled by industrial PCs with displays large enough for multimedia output. Less expensive and older machines and especially some of the mobile machinery are still lacking suitable displays and computing power. At least for service technicians notebook computers will represent a possible substitute.

Multimedia applications are considered to be of benefit during the implementation phase of new machines and plants as well as for training. It is a common problem with knowledge that it will get lost if not used regularly. With the help of suitable interactive training environments workers could refresh their know-how on the job. As a matter of fact both workers and servicemen believe that it would be quite useful to have videos, animations, etc. on various topics available near the machine to support their work. Animated sequences and videos of system functions would improve the understanding of machine performance and are expected to assist in operating and servicing the systems [6].

For locating trouble spots in large systems sound plays an important role. The noise produced by motors and gears can deliver valuable information on the condition of these components. Thus comparing the sound of a well running motor with one expected to cause trouble will considerably help in phases of troubleshooting. Multimedia technical documents could provide the necessary reference sounds.

*D. Most Wanted Features*

When asked about their expectations of product documentation users expressed the following wishes:
- Product documentation should locally be available via Internet in a most up-to-date status,
- product documentation should be customised to the specific needs of the respective user class,
- maintenance schedules and instructions should be delivered in electronic form and be modifiable by the customer,
- product documentation should have an interface to the diagnostic system,
- most of all better and faster access to the relevant information is requested.

*E. User Environment*

It is not always feasible to provide the optimal environmental conditions for the use of multimedia capable equipment. Machinery is often located in rather noisy and dusty surroundings which quickly lead to malfunctioning of electronic equipment unless it is especially tough and well protected. Inadequate light conditions make it difficult to read displays. A lack of power and telecommunication connections hampers access to networks.

Conditions are much better in the offices of foremen and work group leaders. There direct access to multimedia electronic documentation would provide less problems. Most of these offices are equipped with PCs and network access thus providing the necessary platform.

New machines and systems are widely equipped with modern information technology. This includes displays and PCs for controlling the machine processes. However, these PC controllers are not always integrated in production IT networks (LANs) and thus cannot directly access documents either located on a company server or via Internet at remote servers. In some cases modems are attached to the machine controllers in order to allow access for teleservice. Depending and the bandwidth available access to the Internet for electronic documents could be accommodated [??].

The long life expectancies of German machines is valued by their customers. This implies, however, that the stock of machines used in many firms can be quite

old and without modern IT. In general it would not pay off to modernise those machines in order to accommodate on-line access to product documentation.

## V. ANALYSIS

The analysis of the field explorations has produced a number of factors which will influence the further development of product documentation and in particular the use of multimedia elements. These factors have been grouped into *attractions* and *barriers*. Some of them are briefly described below.

### A. Attractions

- The more widespread use of suitable illustrations will improve the acceptance and usability of technical documentation.
- Animated sequences and videos of machine processes will enhance the understanding of machine functions. It is expected that first use of multimedia elements will be in training documents and for refreshing previously acquired knowledge on the job.
- The compact size of electronic documents will be of considerable advantage to servicemen and eliminate the need to carry large volumes of paper documents along on their service calls.
- The possibility to have all the necessary product information available on site and up-to-date will provide for better service, thus reduce machine down time and improve productivity.
- New data structures and the use of standard description languages (e. g. XML) will greatly facilitate the cross-media production of product documentation and also support an easier exchange among business partners.
- With widespread use of the Internet, electronic parts catalogues together with electronic procurement will ease and speed up the ordering of spare parts. Multimedia could be used in catalogues in order to provide more transparent representations of machine components and facilitate the search for the required replacement parts.

### B. Barriers

- One of the most important barrier to the use of electronic and thus also multimedia product documentation will be the difficulty to have suitable means available at the production site for displaying and using electronic media.
- Historically developed infrastructures for producing technical documentation in general will hamper the implementation of the new tools required for producing multimedia documentation.
- Changing to new methods and tools for document production very often implies new organisational structures. Altogether this involves the investment of considerable amounts of money and time.
- Uncertainty about standards and a lack of information and know-how on how the new media could best be utilised continues to hamper its diffusion.
- Insufficient knowledge about the real needs of users

will often lead to less acceptance of product documentation. Switching to electronic versions and adding multimedia elements will not automatically change this.

## VI. CONCLUSIONS

The investigation of user requirements indicates that there exists considerable potential for improvement of today's product documentation. According to the interviewed persons improvements through the use of the new electronic documentation are expected in the usability, the actuality, and the handling. It is generally assumed that some of the shortcomings of printed documentation such as large size and cumbersome searches for information will be resolved.

A survey of producers of product documentation has shown that many of them get little or no feedback from their customers/users. To successfully integrate multimedia elements within product documentation requires, however, to know what the user really needs. Thus a closer look at user requirements should be taken. It could turn out to be a failure if the design and implementation of multimedia elements within production documentation is only based on technologically feasible aspects and does not consider its usefulness to the prospective user.

The study described above has also revealed that one of the most important barrier to the use of electronic and thus also multimedia product documentation is the inherent attachment of the user to paper documentation. It will be necessary to convince the involved persons of the advantages of multimedia electronic documentation.

The requirements for technical documentation are many and diverse. Within an common enterprise information pool the technical documentation will play a major part for the machine building industry. Thus all possible uses of technical information not only at the customers site but also within the firm have to be considered. All steps of a product life cycle from the production of a machine to its installation and integration in the production process at the customers site should be included in the structure and content of the technical documentation.

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