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Topic:

IT Project

Development of a generic „Documentation Extent Model”

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1 Abstract

The current literature available on the topic of “IT-Customizing Documentation” is very rare, and even when the subject is generalized to “IT Documentation”, a specific question is almost never answered or even adressed. The question that often arises in customizing projects is: “ How much energy and effort do we have to put into documentation?”, to get it more precisely the question would be: “Is there an optimal extent of Documentation?”. This question does not derive from technical problems or questions alone, it only comes to the surface if we look at IT-Documentation from both the technical and the economic point of view. Applying the economic theories on the relation between “documentation extent” and “utility of the documentation”, we would expect a “diminishing marginal utility”. Which according to the “law of diminishing returns” will lead up to a point where the marginal cost of further documentation will exceed the marginal utility of that additional unit of documentation. This point could then be called the “economic optimum”.

The aim of this work is to find out if the relation of diminishing returns holds true for documentation extent. Then the influencial factors to that theory are going to be identified and a proposal for a decision support framework will be outlined to support the process of “finding the optimum”.

2 Introduction

2.1 Motivation

What is the “right” amount of of documentation?

The question arose from two different angles, first in the professional practice as an IT-Business Consultant where every cost-estimation for a new project has to include the workpackage “documentation” with an estimation on how many “Man-Days” will be required for it. Every time the consultant has to ask himself and the team, “How much effort do we have to put into documentation?”

The second angle, one comes across by reading the literature about “Agile” methods in IT, especially in the software development areas. There one can read as one of the principles to an agile approach: “Working software over comprehensive documentation” (Kent Beck et al.). Quite a number of experts try to explain that principle to the IT community – all stating: “that agile development methods do not preclude the use of documentation in their processes” (Rubin and Rubin, 2011, pp. 1).

Both of these approaches show that the “right amount of documentation” for a specific IT project is indeed a critical question to consulting and development projects. By examining the literature that deals with documentation in IT projects, it can be observed that the question is not a new one but appropriate methods to deal with it are not present. The issue is raised by quite a few authors, for example in a standard reference on technical documentation in general, we can find the following statement on the “right amount of documentation”: “The amount of time required for documentation can vary from perhaps 10 to 50 percent of the time actually required for the physical installation of a facility’s equipment.” (Whitaker and Mancini, 2013, pp. 9) As this statement refers to technical equipment and facilities one can though assume that the principle will hold true for equally complex software projects. Other authors do not give any indications on the “right amount of documentation” at all, merely we can find as one point to answer in a checklist to review the content of documentation: “Is the content of the document complete?” (Reiss and Reiss, 2009, pp. 334), which has to be answered by the professional without any further elucidations. Another approach often found in literature concerning the correct amount of documentation is that the author of the documentation has to “estimate how extensive and detailed” (Juhl, 2005, pp. 92) the documentation has to be.

Authors describe “Agile” methods such as Rüping describe the problem as follows: “Project documentation is most effective when it is lightweight, without any unnecessary documents, yet providing all the information relevant to readers.” (Rüping, 2003, p. 193)

The main question as we can see from this quote is therefore which is “relevant information” and what can be excluded from documentation as “unnecessary”, in the subsequent paragraphs

implying that it lies in the responsibility of senior professionals to judge the “right amount” by their experience and common sense, not offering a specific methodology to act by.

Derived from this issue outlined, this paper tries to classify two points, first will be, what characterizes the “right amount of documentation” and which factors affect it. Second will be how can these factors be arranged into a framework that helps decision makers to determine the optimum on a case to case basis.

2.2 Research Question

As indicated above documentation of IT projects is not self-sufficient, it does serve a cause and to be appropriate to that cause with the least possible resources spent, is very difficult to achieve.

The **research question** can therefore be stated as follows:

IT documentation can exceed the cost benefit equilibrium, which means that above a certain point further documentation produces more costs than benefit.

How can IT professionals determine the cost benefit equilibrium, to optimize costs and effort spent for documentation?

Since this does not have a simple answer the aim of this paper is to examine the question and current literature and eventually produce a kind of framework that can help professionals in the process of determining the “right amount of documentation”

2.3 Structure of Work

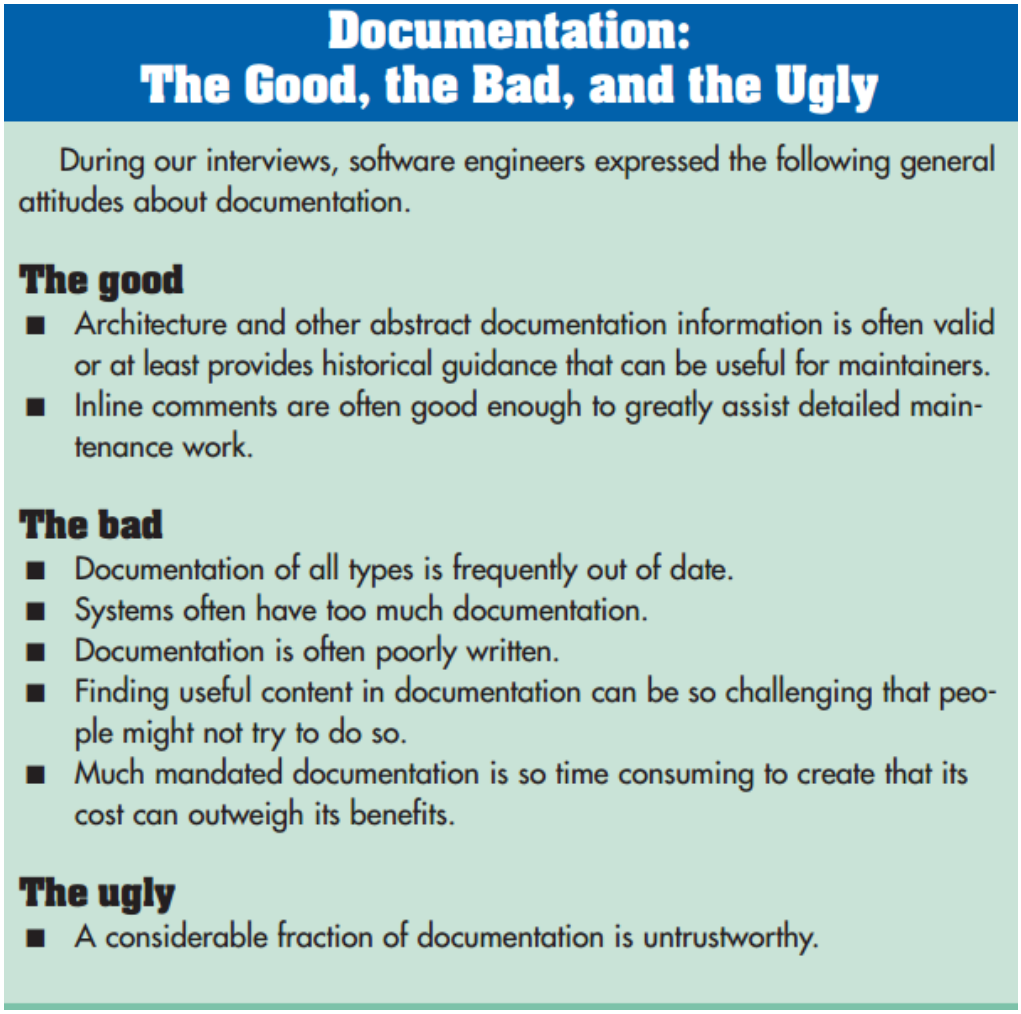
The paper is structured as follows, first a basic description of IT documentation with an outlook on the current state of practice is given. Then the different factors that influence the amount of documentation needed are evaluated. The third essential part is the explanation of the method for the conducted expert interviews and a description of the findings.

Finally a conclusion from both the examination of the literature and the interviews is drawn.

3 Basics of documentation

IT documentation is a controversial issue in the business, depending on which function an IT professional has in its organisation, very different views and opinions to the matter can prevail.

As shown in Figure 1 the IEEE – engineers association therefore has conducted interviews with software engineers, asking for their attitude towards documentation.



Documentation: The Good, the Bad, and the Ugly

During our interviews, software engineers expressed the following general attitudes about documentation.

The good

- Architecture and other abstract documentation information is often valid or at least provides historical guidance that can be useful for maintainers.
- Inline comments are often good enough to greatly assist detailed maintenance work.

The bad

- Documentation of all types is frequently out of date.
- Systems often have too much documentation.
- Documentation is often poorly written.
- Finding useful content in documentation can be so challenging that people might not try to do so.
- Much mandated documentation is so time consuming to create that its cost can outweigh its benefits.

The ugly

- A considerable fraction of documentation is untrustworthy.

Figure 1 - Documentation: State of the Practice (Timothy C. Lethbridge, Janice Singer, Andrew Forward)

The summary of the results of those interviews is painting a bad picture of the current practice, the two good points they identified is that abstract systems overviews are often correct and inline code documentation are helpful. However they identified a lot more downsides in the attitudes, software engineers stating that documentation is often outdated, poorly written, not easily accessible. Two points in “The bad” category are especially interesting for the question at hand: “Systems often have too much documentation” and “Much mandated documentation is so time consuming to create that its cost can outweigh its benefits” (Timothy C. Lethbridge, Janice Singer, Andrew Forward). These results are interesting and also directly lead to the question how do we determine the right amount of documentation and how do we prevent having the cost outweigh the benefits of documentation?

Despite these downsides of documentation in current practice, of course the benefits of documentation are not doubted a all.

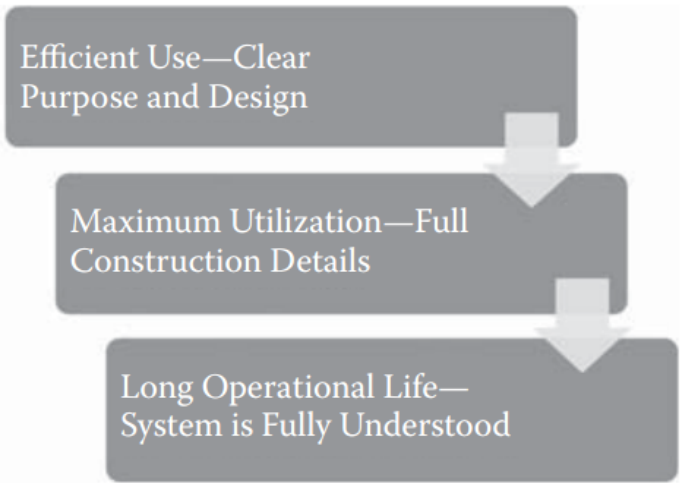


FIGURE 2.1
Benefits of a well-documented project.

Figure 2 – Benefits of a well-documented project taken from (Whitaker and Mancini, 2013, pp. 10)

As shown in figure 2 the benefits of a well documented project range from the possibility to make efficient use of the system with a clearly stated purpose and design, over to the maximum of utilization of the system due to full access on the construction details to a likely long operational life because the system is fully understood. This is not specifically tailored to IT projects, but is rather true for all technical documentation.

As explained earlier, finding the “right amount of documentation” for an IT project in general and an IT customizing project in particular is not an easy task to accomplish.

From a standard reference on technical documentation in general, we can find the following statement on the “right amount of documentation”: “The amount of time required for documentation can vary from perhaps 10 to 50 percent of the time actually required for the physical installation of a facility’s equipment.” (Whitaker and Mancini, 2013, pp. 9)

Another factor that holds true for technical documentation and therefore very likely also matches for equally complex IT projects is: “Inadequate documentation is a major contributor to the high cost of systems maintenance” (Whitaker and Mancini, 2013, pp. 9).

Having outlined some basics on documentation, in the following chapter the factors that influence the amount of effort necessary for documentation will be examined.

4 Factors Influencing the Amount of Documentation

Important to help developing methods for aiding to find the “right amount of documentation”, are several factors. Determining these factors and explaining how they influence the process of determining it is the subject of the following chapters. First will be an overview of the basic types and motivations of documentation, second will be an explanation of the correlation between Utility and Effort put into documentation. Third will be an overview on the different types of projects and an explanation how these influence the “right amount of documentation”.

4.1 Different Types of Documentation

Documentation for IT projects can have very differrent motivations, and in the documents describing a specific project there are also often different motivations for different documents. For example a very thorough specification document is in most cases essential for a fixed price project. The motivation for the creation of that document and for its quality assurance is an economic necessity to both the contracting parties. On the other hand one could imagine a project with various experts involved for different parts of the software development or customizing, where it might be economically reasonable for the consulting company to create and maintain a document from which the maintenance or support team can readout the person who was originally responsible for the module in question. By having this document at hand in the case of an incident, the support staff can quickly find the expert with the first hand knowledge if assistance is needed and can hereby significantly speed up the process.

As demonstrated by these two examples there can always be made a distinction between “necessary” and “On-Top” documentation (Osterhage, 2009, pp. 109ff). The two different categories of motivation therefore are either the organisation finds that it is necessary or it is expected to benefit the organisation beyond the mandatory level (Reiss and Reiss, 2009, pp. 19).

The part of necessary documentation often is motivated by beeing officially required by laws or other standards such as the generally accepted accounting principles (i.e. GAAP, GoB). These motivations however can be further distinguished into those required “by law” and those required for certification reasons. Although one could argue that the documents mandatory for certifications such as ISO 9001 or IDW 330 also serve the economic benefit of an organisation and are not mandatory per se, and therefore might be categorized into “On-Top” documentation, it makes sense to consider it “necessary” documentation. This is because to the persons in the organistion that have to determine the “right amount of documentation” and furthermore create and maintain it, the question wether a certification is scheduled or not merely is a given fact.

Another way to classify the different types of documentation is to look at it from a more formal point of view, such as Reiss et al. (2009) put the motivations into three categories.

Figure 3 - Motivations for Documentation (own representation based on Reiss and Reiss, 2009, pp. 21)

As a first category “regulations by law” were identified aggregating the legal regulations such as company related laws (i.e. AktG, HGB, AO) and general laws in the country in question. Second group are the norms and standards as described previously, aggregating ISO-norms (i.e. ISO 9001), BSI-standards and other auditing standards. As the third category Reiss et al. stated “models” referring to IT frameworks such as COBIT and ITIL. These models however aim at the creation of additional benefit for the organisation and therefore do not contrast the previous categorizations.

As seen in the previous paragraphs the categorization into “necessary” and “On-Top” documentation is a kind of simplification that is favourable for the issue adressed in this paper.

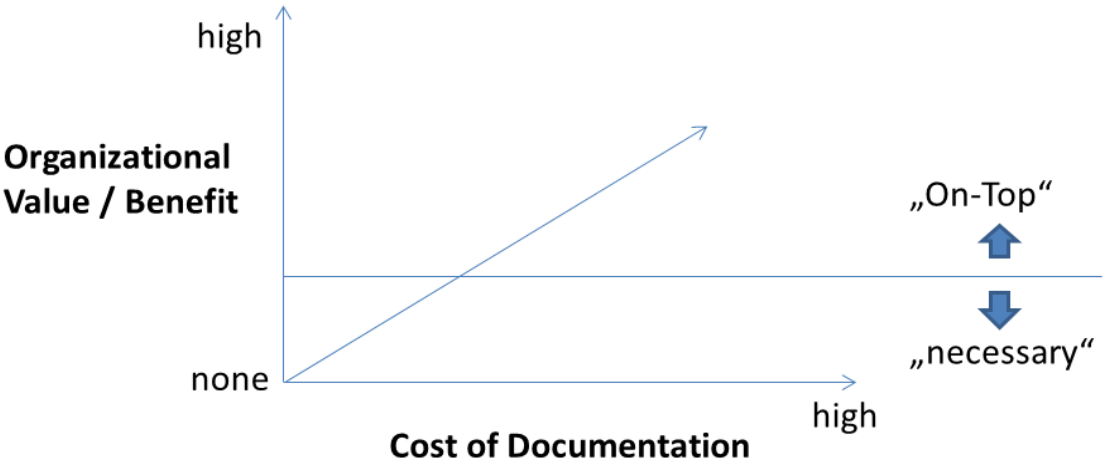


Figure 4 - Distinction between "On-Top" and "necessary" documentation

For the further descriptions of the subject a restriction to the “On-Top” type of documentation is reasonable because the “necessary” documentation can be seen as a fixed factor that does not

influence the search for the “right amount of documentation”. This is because the amount looked for is always at least at the point of “necessary” documentation. The representation shown in figure 6 shows this connection and also points to the question, how the curve of the correlation between organizational benefit and cost of documentation is shaped. This question will be adressed in the following chapter.

4.2 Diminishing returns on Documentation

Although not explicitly stated it seems to be a basic principle of documentation “the more you document the better” – that this may not always be true is a relatively new point of view in the literature and can be found in the books and articles that deal with the “Agile Manifesto” principles.

There are several reasons that lead to the conclusion that the return in terms of utility diminishes with the extent of documentation. To describe this dependency we can distinguish the factors into two categories, first is the rising costs associated with documentation and the second category is the additional utility of documentation.

The category of factors that influence the cost of documentation mainly consists of creating documentation, maintain the actuality of documentation and retrieve the needed information. The factors that influence the costs of documentation can be extended to a fourth factor, as does Ding (2009) with the “Document distribution”. The four cost drivers he established added the document distribution remarking that the documentation has to be accessible to the teams that need it in the later phases of the systems lifecycle (Ding). However this step will be taken out of the further analysis because they can also be summarized in the document retrieval factor.

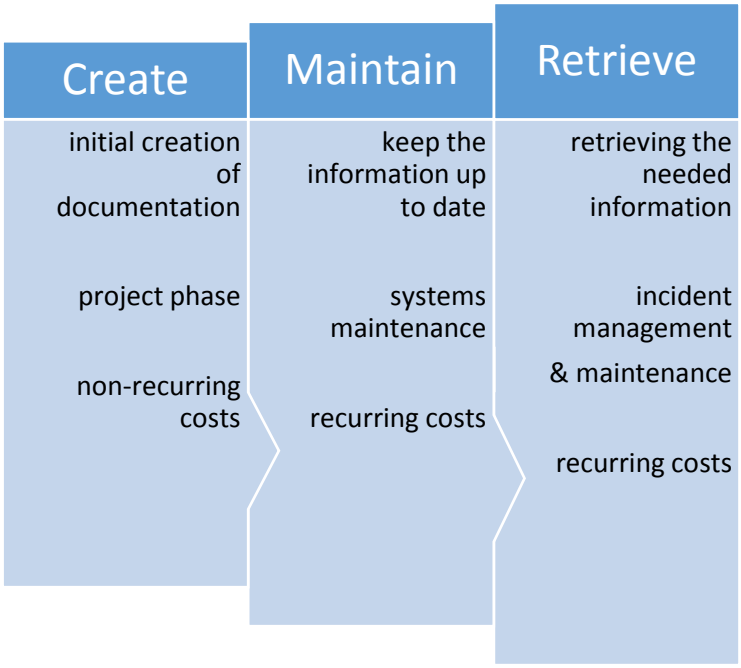


Figure 5 - Cost factors of documentation (own representation based on Reiss and Reiss, 2009)

As shown in figure 4, the three cost factors to documentation can be matched to different phases of the systems lifecycle. Beginning with the initial creation of the documents as a non-recurring activity in the project phase, switching over to systems maintenance where every change made to the system has to take effects on the accompanying documentation. The third step is the information retrieval from the documentation, this can either be part of the incident management for the system or during maintenance activities. Matching these three cost factors, the influencing properties of documentation are shown in figure 5.

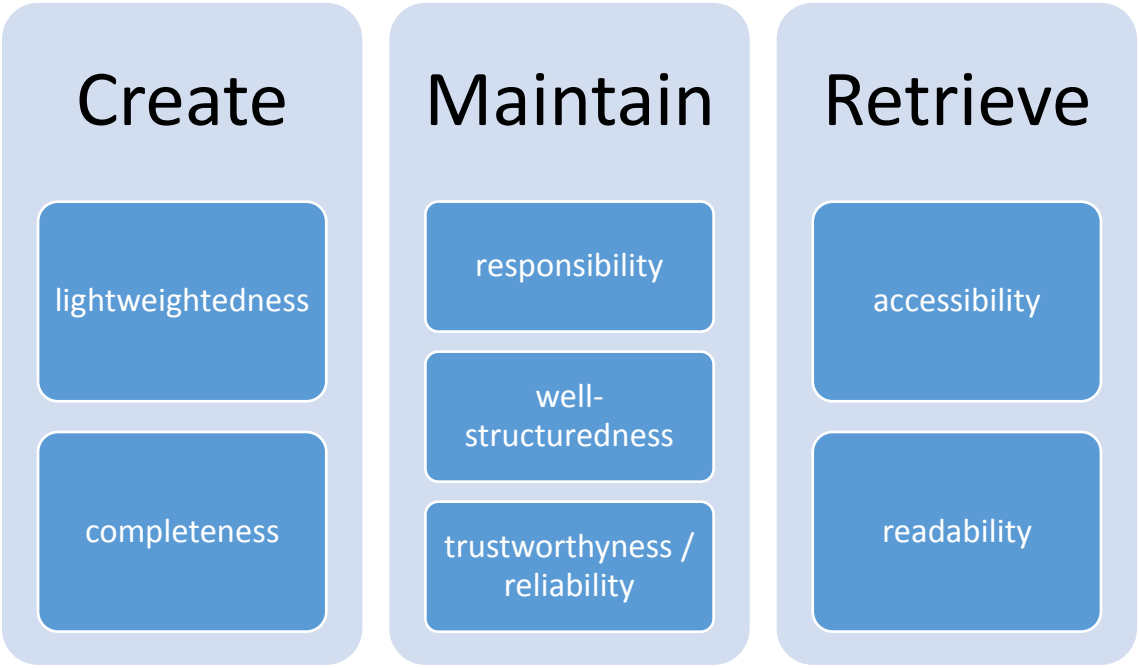


Figure 6 – Examples of Documentation properties that influence the costs ordered by cost-drivers

In the initial creation of the documentation it is the most important feature to the costs related, that the documents are lightweight and complete. This is where the experts have to determine the right amount of effort to put into documentation, to a point between “not documented at all” and “overdocumented”. Every hour of effort put into initial creation directly affects the associated costs, while one has to keep in mind that this is a non-recurring activity and therefore the costs only arise once whereas the later activities are likely to recurr.

The second large category that influences the relation of costs to benefit of documentation is regarding the benefits. As Rüping (2003) explains in the current information age we are surrounded by information that is often too much (Rüping, 2003, pp.12).

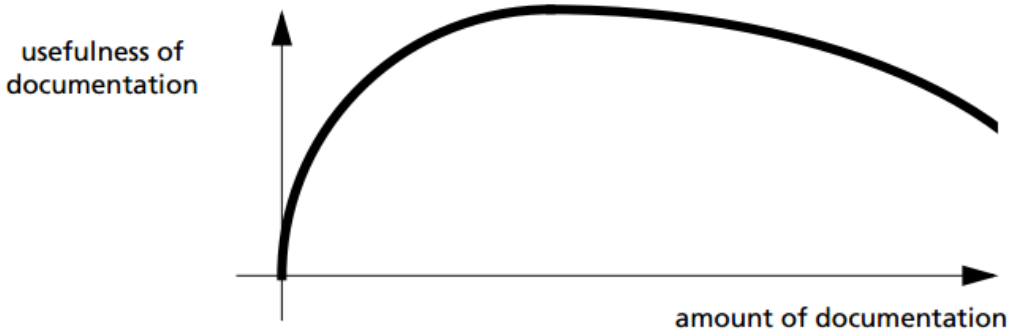


Figure 1. The usefulness of documentation

Figure 7 - figure Taken from Rüping 2003 p. 4

As Rüping explains, the amount of documentation correlates to its usefulness in a way that follows the principle of diminishing returns (Rüping 2003). As the reason for this relationship he states, that 'finding relevant information becomes more and more difficult as the overall amount of documentation increases' (Rüping 2003 p.4)

The effects of having an extensive documentation are various, for one point all the information that is required in later phases can be found in it, however the amount also decreases the usability of the documents. Especially the filtering of relevant information for a problem at hand gets more and more difficult with the amount of documentation. Therefore the risk of "overdocumenting" a project or system is a real threat to the utility of documentation. The second problem with the benefits is, that only up-to date information can help and any piece of information found in the documentation that is not accurate can rather impact the situation to the worse (Rüping, 2003, pp.12). There are two reasons why information can be inacurate regarding the amount of documentation, first is that the quality of documents tends to go down with the amount of documentation, rather delivering volume than quality. The second of the reasons is that it becomes more and more difficult to maintain a document over time. The more documentation there is, the more has to be regularly updated and checked. Especially in complex systems with lots of different parties involved, the probability of no longer correct information in the documents rise. As explained in an article of the IEEE: "Most software documentation is not updated consistently, but outof-date documentation might remain useful. We must find powerful yet simple documentation strategies and formats that software engineers will likely maintain" (Timothy C. Lethbridge, Janice Singer, Andrew Forward). In that we can see that outdated documentation is a real problem and the IEEE is working on strategies that will help the engineers to maintain the documents regularly.

With the information gathered in the previous paragraphs, the initial figure showing the correlation between costs and benefits of documentation can be further adjusted.

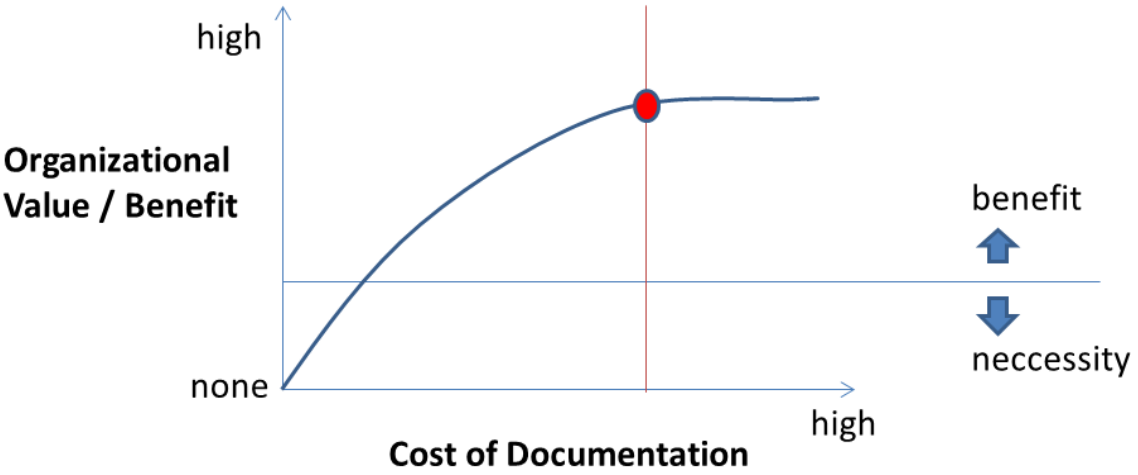


Figure 8 - Correlation between beneft and cost of documentation

As shown in figure 7 the correlation adjusted to resemble the “law of diminishing returns” leads to the conclusion that in fact there is an optimum

4.3 Types of IT-projects

IT projects have a wide range of different approaches, techniques and subjects. Each variation results in different requirements for the documentation, this can for example be the difference between old technology and new technology (Rüping, 2003) or the difference between small projects and large projects (Rüping, 2003). The different characteristics of IT-Projects all have an influence on how much effort has to be put into documentation. However it is not always clear in which direction a constrastive pair of attributes points in terms of effort, this is to say that for example if a project is concerned with “new technology” it is not clear that in any case more documentation is needed than for “old technology”. Apart from this problem, in the following figure a collection of pairs is shown, with the columns indicating what “normally” means more documentation (+) and less documentation (-) needed.

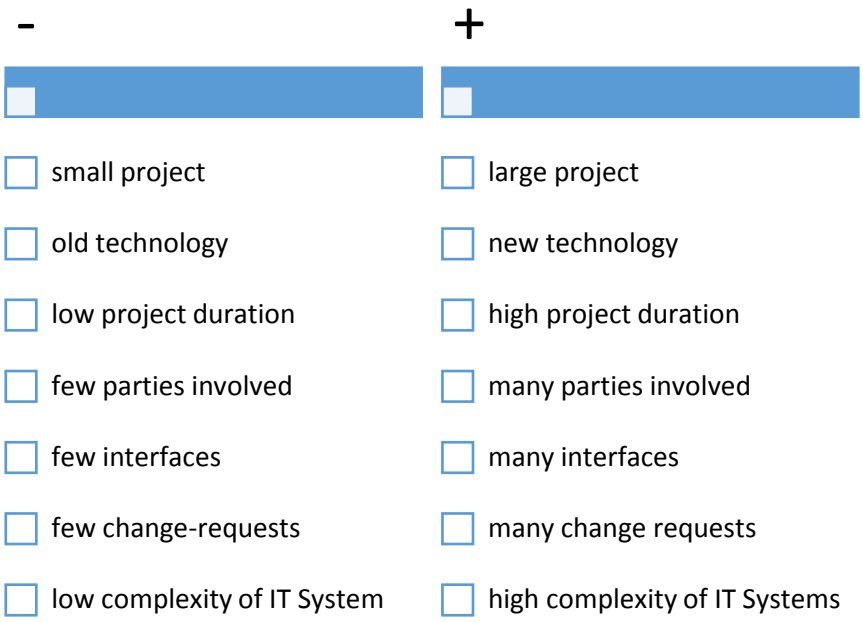


Figure 9 – Example IT-Project characteristics that influence the amount of documentation

The characteristics sampled in Figure 7 are by no means complete, but show that any factor that influences the complexity of an IT-project also influences the amount of documentation that is appropriate to it. In many cases the experts responsible for creating operating instructions for the organisation therefore ignore most of these factors and limit their considerations to only one or two of those characteristics. For example it makes perfect sense for a consulting company that wants to give itself operating instructions on how to determine the appropriate efforts, to define a rule that states: “At least one-third of the estimated project man-days have to be allocated to documentation”. By this rule, the experts to decide on a project-to-project basis have a guideline that they can alter if for example the complexity of the IT-System demands it.

The downside of this one dimensional approach however is, that by limiting the factors in consideration, the guideline also does not match the requirements of every project type. If for example a software update is scheduled for an existing customer with an effort of two man-days, and additional one day for documentation this will not resemble the effective effort because it is a recurring task and documentation can be adopted from previous projects.

5 Expert Interviews

The method to gain insights ino professional practice and to support the assumptions made for the “documentation extent model” is conducting qualitative interviews with IT-specialists. The method was developed with the desciptions of Töpfer (Töpfer, 2012, pp. 244f), following the proposed steps for a low-abstracted oral interview, in which the experts are encouraged to answer freely to situations and questions that are previously established in a questionnaire.

A very important factor in the quality of these interviews is that all the interviewees recruit from the customers and employees of the Henrichsen AG. The structure of Henrichsen AG as a small enterprise with about 140 employees (2014) and a customer base mainly consisting of small to medium sized enterprises, has effects on the answers. This results in limitations to the applicability of the results for any kind of generalization, however the results can give an insight on the state of practice.

5.1 Expert Interviews Part 1

Part one of the Interviews conducted, has the aim of raising the question of the “optimal amount of documentation” to the experts and if possible extract any ideas or methods they know of concerning it. The questions were posed in a personal interview and the interviewees did not know the questions and subject beforehand. This resulted in quite spontaneous answers without preparation.

No	Question		Aim of the Question
1.0	What importance do you assign to documentation in IT-Customizing projects?	Wie würden Sie die Wichtigkeit von Dokumentation in IT-Customizing-Projekten einschätzen?	Gain insight on the taughts about importance for IT-Customizing projects, especially if the SME´s distinguish “IT-Customizing” projects from other types of projects.
1.1	Do you think the actual effort on Documentation resembles	Glauben Sie die Dokumentationspraxis spiegelt diese	Learn on how serious the organizations and

	its importance in professional practice in your organization?	Wichtigkeit im Tagesgeschäft korrekt wieder?	experts are about documentation.
1.2	Would you say that “overdocumentation” is possible?	Würden Sie zustimmen, dass “überdokumentation” prinzipiell möglich ist?	To find out wether „overdocumentation“ is something that the experts experience in their everyday business. Or if this a new concept to them.
1.3	Do you know and/or make use of a scientific technique to determine the utility of documentation?	Kennen / nutzen Sie eine Methode den wirtschaftlichen Nutzen von IT-Dokumentation zu bewerten?	To find out if the economic value of documentation is something that actually has a part in the considerations of professionals.
1.4	How do you / does your organisation determine the amount of documentation necessary for an IT project or System?	Wie legen Sie / Ihre Organisation den Umfang der Dokumentation für ein IT Projekt oder System fest?	To find out if there are any methodologies or guidelines that the SME´s use to determine the amount of effort to put into documentation or if they purely rely on their experience and gut feeling when they plan the efforts.

5.2 Expert Interviews Part 2

The second part of the interviews was conducted between 10 to 14 days after the initial interviews. The interviewees are the same and can be referenced by the titles. The situation of the interviews was also an oral interview, with the respondants having known the subject upfront.

No	Question		Aim of the Question
2.0	Are you satisfied with the overall quality and amount of documentation you receive from external service providers (i.e. system integrators, Software developers) or deliver to your customers?	Sind Sie im Allgemeinen mit der Qualität und dem Umfang von Dokumentationen, die Sie von Dienstleistern erhalten, oder Ihren Kunden liefern zufrieden?	The question aims to find out wether the quality of documentations from external providers was actually measured or not. An implied follow up also was to find out how this was done.
2.1	Please give the 3 most important and/or meaningful quality criterias for IT Documentation.	Nennen Sie die drei Ihrer Meinung nach wichtigsten und/oder aussagekräftigsten Qualitätskriterien für IT Dokumentation.	To measure quality of IT documentation one must define criteria for that, therefore the question aims to find out which criteria might be suitable.
2.2	Please rate the following quality criterias in school grading from 1 most important to 6 least important	Bewerten Sie folgende Qualitätskriterien für Dokumentation im Schulnotensystem von 1 am wichtigsten bis 6 am wenigsten wichtig.	A subset of possible criteria to measure quality of IT documentation should be rated on a scale to find out which were perceived the most important

	Completeness, readability, correctness, audience directed, consistency, layout, ease of access, actuality, traceability, extendibility	Vollständigkeit, Lesbarkeit, Korrektheit, Zielgruppen adressiertheit, Konsistenz, Klarheit des Layouts, Verfügbarkeit, Aktualität, Nachverfolgbarkeit von Änderungen, Erweiterbarkeit, Umfang	
2.3	Do you/does your organisation assess the quality of documentation delivered from service providers?	Prüfen Sie / Ihre Organisation die Qualität von Dokumentationen, die von Dienstleistern geliefert werden?	To find out if there are quality measurements in place to assess the quality of documents

5.3 Findings from Expert Interviews

The expert interviews conducted, show the personal view of five experts in IT project management, as explained beforehand, although the selection was made to bring in different views and branches this aspect was somewhat limited. Therefore the conclusions drawn from the iterviews can only serve as an explorative approach to find new ideas and aspects to the issue and generalization to the “state of practice” in IT consulting have to be handled with extreme caution.

As explained in chapters 5.1 and 5.2 the questions were developed beforehand to serve as a guideline through the personal oral interviews. In the following a summary to the issues regarded will be made.

The first question was aimed to find out how the importance of IT documentation is judged by the experts. What we can find from the statements is that there actually is not debate to wether documentation is important or not, however what we can see is that in some branches the formal requirements to documentation are more present than in others. Especially the two interviewees from the pharmaceutical background stressed that there are requirements to documentation that arise from external and internal auditing. Therefore their view on the benefits of documentation was very different from those of the other interviews.

This quite resembled in the question on how serious the different organisations handle the issue of documentation. All of the questioned experts stated that despite the importance of documentation is readily acknowledged in their organisation it is somewhat left behind in terms of the actual efforts spent on documentation activities.

The question 1.2 regarding the term of “overdocumentation” showed that it is not a frequently observed situation in the organisations that were part of the interviews. This might have two possible causes, first is that overdocumentation can only be found with the economic point of view in mind. Technically a documentation that covers every eventuality is considered impossible as was stated in interview B1. Therefore it would also impossible to overdocument a system, until we bring in the theory of the diminishing returns of documentation, only then it becomes clear that a system is actually overdocumented, long before every eventuality and detail information is considered. The possible second reason is that the organization keep the efforts for documentation as low as possible and therefore never get to the point where one could observe overdocumentation.

From the answers to the fourth question it can be seen that the concept of measuring the benefits of documentation is seen as a merely theoretical concept by the interviewees and is not conducted in any of the organisations. However as can be seen in the interview E1 there is a possible course of action to determine the benefits in a case analysis. The interviewee proposed an experiment, in which a specific piece of information has to be found by two contestants of which one only has direct access to the system and the other has access to the systems documentation. Then the time to find the information should be measured and the saving of time with documentation would be considered its benefit. This in fact is a very interesting approach because one can actually put economic value into the equation (i.e. costs per minute searching information) and subsequently calculate the benefit in monetary units.

Also very interesting are the answers to question 1.4 regarding the estimation of how much effort has to be put into documentation. This gets right to the overall issue of determining the “right amount of documentation”. What can be seen from the answers is that none of the interviewees is given a set of rules by their superiors or any other generally accepted framework in place. All are relying on personal and organizational experience in their field and estimate without given guidelines. However the two interviewees from the pharmaceutical industry stated that they use the standard and guidelines from the auditing institutions to determine what has to be part of the documentation. That of course only covers the part of “necessary” documentation and leaves out the possibility of “On-Top” documentation, relying on the impression that this is sufficient for the organisation as a whole.

As the first round of interviews was conducted rather early in the project, further questions rose along the way partly inspired by the answers to the first questionnaire, therefore a second shorter questionnaire was developed as a guideline for the second round of interviews.

The second series of questions mainly deal with the quality measurement of IT documentation. It is important for this paper to know wether there actually are quality criteria and measurement guidelines in place at the companies because those could impact on the further development of a documentation extent framework.

The first question tried to find out if there are issues with documentation quality and extend in professional practice and especially if and how the quality was measured. The results show that there are no formal procedures on quality measurement in place, except from the annal audits in the pharmaceutical sector. Also the interviewees did not come up with any specific ideas on how the quality measurement could be done.

In the second question of round 2 the three most important quality criteria for documentation were asked, the interviewees all stated that the “correctness” of information is one of the three most important criteria. This was subsequently confirmed by the ranking of quality criteria from question 2.2 in which all interviewees gave the “correctness” of information a “most important”. Second in the ranking was the “actuality” of information.

Finally question 2.2 aimed to find out wether the organisations actually check the quality of the documentation delivered by external service providers and how this is done. Again the enterprises in the pharmaceutical industry differ from the others by having at least an informal assessment process in place. This is due to the fact that they have to look at the annual audits in advance and rule out possible complications right from the start. The other experts agreed that in most companies the quality assurance of documentation is very easy-going if present at all.

6 Conclusion

The original question “How can we determine the right amount of documentation?” was approached from different angles in the previous chapters. First of all the motivation for working on the issue was laid out, it is a question that on the one hand is a practical everyday question to IT consultants and on the other hand the “amount of documentation” is a considerable cost factor for IT projects as a whole. From that the research question was derived: **“How can IT professionals determine the cost benefit equilibrium, to optimize costs and effort spent for documentation?”.**

After this in chapter 3 a basic understanding of the costs and benefits of documentation was established, especially the problems of documentation such as the difficulties keeping documentation up to date and the costs that sometimes outweigh the benefit of comprehensive documentation were laid out.

In chapter 4 the first steps to a model of documentation extent and its dependencies were evaluated, beginning with the different types of documentation and their specfic motivations. It was established that there are basically three types of documentation, of which only the “On-Top” or “model”-motivated documentation can be the subject of finding an optimum, because the other two, required by law and required by standards, can be considered as “necessary” and have to be done anyways.

Next it was established that the economic law of “diminishing returns” apply to the relation between costs and benefit of documentation. By this it became clear that there is in fact the posibility of “overdocumenting” a system when assessed by both technical and economic principles.

In the following chapter 4.3 the different characteristics of IT projects were examined, that influence the “right amount of documentation” for the project. Therefore a number of contrastive pairs of characteristics were collected and the one dimensional approach of using one of the pairs to determine the amount of effort one has to put into documentation was described.

Taking all these factors into account, a process model for determining the optimum can be derived.

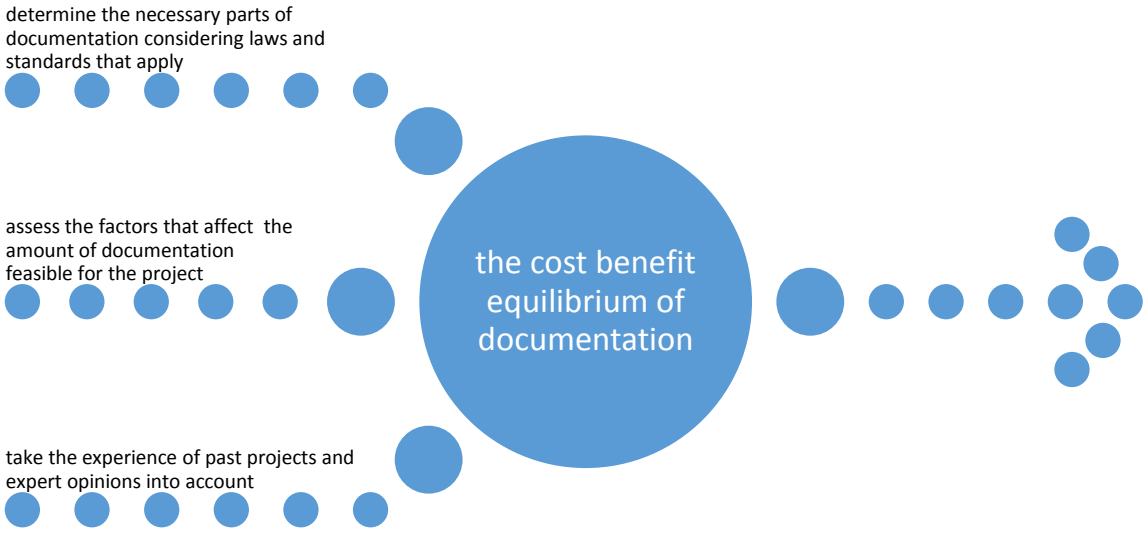


Figure 10 - Proposal of a process model to find the cost-benefit equilibrium

The first step in the process as shown in Figure 10 is to determine the “necessary” parts of documentation that are mandatory by law or standards that apply to the project. This can include tax laws, laws of IT-Security and different certification standards such as ISO standards or branch specific standards.

In a second step one has to take the project specific characteristics such as size and complexity of the project, and/or the IT system in question, into consideration. These characteristics differ throughout project types and organisation, again also the specific branch also plays a role here.

With the first two steps acquired, the expert opinions have to be taken into account. As explained in the previous chapters and confirmed by the expert interviews in chapter 5, many organisations currently rely solely on these “soft-factors”. That is with good reason, because the subject of IT projects and the influencing characteristics to IT documentation are too complex to be put into a simple one dimensional model to determine the optimal amount of efforts to put into documentation.

With this first, although very abstract, proposal in mind, the next step is to develop a framework that fits the specific projects at hand. A company may have to build several instances of the framework, each serving only for a specific project type. A simplified instance for this approach could look as follows.

Documentation extent model DEM1

Applicable for projects introducing “Employment Records Systems”, ranging from 6 to 15 man-days.

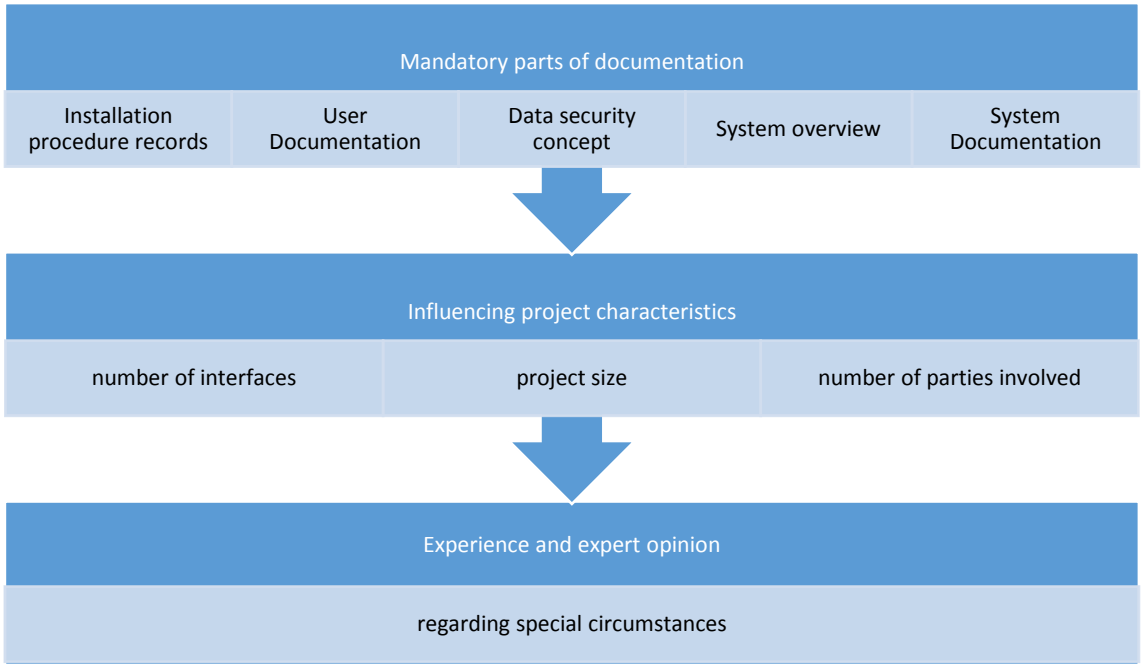


Figure 11 - Example documentation extent model 1 (DEM1)

As shown in figure 11 of the example documentation 1, the three different factors introduced with the process model of figure 10 are supplemented with specific documents, characteristics that are especially influencing on the cost-benefit equilibrium and as a corrective instance the description of situations where the project manager can refer to expert opinions to alter the results if needed.

Based on this draft for a “Documentation Extent Model” the organisation can further enhance the framework with specific numeric values in order to enable the project manager to calculate a recommendation from the first two steps. This recommendation has to be reviewed in step 3 by the IT experts of the project team to result in a final proposal of the efforts necessary to get a both comprehensive and lightweigt documentation.

In order to do that a specific measurement unit for the project complexity (from process step 2) has to be defined as well as factors to accompany each “mandatory” part from step one. In a simplified example this could look as follows, for writing an installation procedure record, an effort of 4 working hours has to be planned, for a a User documentation one has to plan 1 working hour for each man-day of the project.

However the enhancements of the documentation extent model with numeric values is not part of this paper, if this approach to further enhance the model is in fact feasible has to be subject to further investigation.

What can be stated as a more general result, is that the process model to find the cost-benefit equilibrium and the proposal for a documentation extent model, both have in common that they are not “fixed results” that apply to every IT project. They both have to be understood as starting points that may help an organisation to develop a model for a specific type of project. The project characteristics to be taken into consideration also differ greatly for the types of projects.

Appendix

Primary Data: Expert Interview Results

Part 1 – Expert interviews results

Interview A1

Company Profile	
Branch of Industry	Pharmaceutical Research
Country of Operations	Germany
Job description of interviewee	Quality assurance representative
Years of experience in IT project management	10 years / part time

	Date of the interview: 10.06.2014	
1.0	What importance do you assign to documentation in IT-Customizing projects?	Since our organisation underlies several regulations (such as ISO standards and specific regulations for the pharmaceutical industry), documentation is always a very important point in our projects. Especially in my function as quality assurance representative I often have to object to documentations handed in and assure the quality necessary for auditing.
1.1	Do you think the actual effort on Documentation resembles its importance in professional practice in your organization?	Often the amount of effort required for proper documentation is underestimated at first but we keep a close watch on it.
1.2	Would you say that “overdocumentation” is possible?	I personally have never seen a “complete” documentation of an IT system. In any docu-

		mentation there are missing some pieces of information, however the effort to do a complete documentation would probably be too expensive to ever achieve.
1.3	Do you know and/or make use of a scientific technique to determine the utility of documentation?	Not exactly, we rely on our experience in the field to ensure good quality.
1.4	How do you / does your organisation determine the amount of documentation necessary for an IT project or System?	To determine wether a documentation is sufficient or not we consider if it would pass through the mandatory audits and therefore take our previous experiences with the auditing organisations into concern. I also get trainings on a regular basis from the institutions where the details of standards and regulations are discussed.

Interview B1

Company Profile	
Branch of Industry	Pharmaceutical Industry
Country of Operations	Switzerland, Germany
Job description of interviewee	Person responsible fo application management, Enterprise Content Management Systems
Years of experience in IT project management	26 years

	Date of the interview: 11.06.2014	
1.0	What importance do you assign to documentation in IT-Customizing projects?	Very important, for systems maintenance we have to rely

		on the documentation a great deal. We have to be sure that all information needed to keep the system running under extreme circumstances is available.
1.1	Do you think the actual effort on Documentation resembles its importance in professional practice in your organization?	To some extent I would say yes, we take great efforts to train our software developers to get past that initial “unwillingness” to document and frequently fight the urge to make oneself irreplaceable through not documenting.
1.2	Would you say that “overdocumentation” is possible?	Can You explain what you mean by that? (Explanation: Do you think that it is possible that the documentation for a specific system is too extensive?) In principle it may be possible, and it might be that we have done it in certain cases, but there is no indication for that. Sometimes I see very detailed informations, that may go beyond the actually required informations such as detailed screenshots of the system installed, but on the other hand there might be a case where exactly this detail-information might be useful. If you find it that is to say.
1.3	Do you know and/or make use of a scientific technique to determine the utility of documentation?	No. I think measurement of utility is a very theoretical thing that would be very hard

		to do in everyday-work.
1.4	How do you / does your organisation determine the amount of documentation necessary for an IT project or System?	There is two parts to it, first we know what kinds of documents are needed for the formal annual audits. Then there is a lot of experience and know-how of former projects that help to “estimate” the effort quite well.

Interview C1

Company Profile	
Branch of Industry	IT Consulting (former inhouse IT for housing cooperative)
Country of Operations	Austria
Job description of interviewee	Senior software developer and project manager
Years of experience in IT project management	15 years

	Date of the Interview: 17.06.2014	
1.0	What importance do you assign to documentation in IT-Customizing projects?	I personally think that documentation in IT projects is very important. I have seen systems that somehow got “orphaned” over the years because the one inhouse expert that maintained it for years left the company. Also there are cases where the external service provider was no longer available or changed for some reason. In these cases without a usable and accurate documentation

		sometimes they were declared “legacy” systems and scheduled for replacement without the actual need for that. These projects cost a lot of money that could have been saved by taking the effort for creating documentation.
1.1	Do you think the actual effort on Documentation resembles its importance in professional practice in your organization?	No, I think it is treated simply as a cost factor and held to a minimum. We create and expect our service providers to deliver documentation to cover the basic aspects and furthermore rely on the expertise of the employees and their ability to hand over the knowledge needed for maintenance to the team orally.
1.2	Would you say that “overdocumentation” is possible?	I have actually never heard that term. (short explanation through the interviewer) I think whilst it may be theoretically possible we never had a case here.
1.3	Do you know and/or make use of a scientific technique to determine the utility of documentation?	No, there is a kind of feeling that the effort is worth it, but I do not know of a method to measure it.
1.4	How do you / does your organisation determine the amount of documentation necessary for an IT project or System?	There is no rule to determine the effort. We judge by experience and rely on the service providers for estimation if the projects are contracted out.

Interview D1

Company Profile	
Branch of Industry	IT Consulting
Country of Operations	Germany, Austria, Switzerland
Job description of interviewee	Senior Consultant and project manager
Years of experience in IT project management	19 years

	Date of the Interview: 17.06.2014	
1.0	What importance do you assign to documentation in IT-Customizing projects?	The problem with documentations is that they are frequently containing false informations. Therefore I seldomly rely on the documentation itself when an incident with a system arises. I rather look at the customizing itself to find out the information I need. It is however extremely important for us to have reliable information about certain things such as passwords, server infrastructure (server names) and remote access instructions.
1.1	Do you think the actual effort on Documentation resembles its importance in professional practice in your organization?	The effort a third party provider actually puts into documentation greatly differs from project to project. Mainly that's because we estimate the effort before the project actually starts and plan the matching resources. Then when the project is underway the factor of approaching deadlines or budgets influences the time

		and effort spent on documentation. I dare to say sometimes the time-slots allocated to documentation serve as kind of a safety buffer for the project as a hole and the resulting documentation limits to a minimum.
1.2	Would you say that “overdocumentation” is possible?	
1.3	Do you know and/or make use of a scientific technique to determine the utility of documentation?	
1.4	How do you / does your organisation determine the amount of documentation necessary for an IT project or System?	

Interview E1

Company Profile	
Branch of Industry	IT Consulting
Country of Operations	Germany, Austria, Switzerland
Job description of interviewee	Senior Technical Consultant
Years of experience in IT project management	15 years

	Date of the Interview: 17.06.2014	
1.0	What importance do you assign to documentation in IT-Customizing projects?	I think documentation is very important. Especially for large and complex systems, it is a matter of speed. What is going to be faster: searching the information in documentation documents or rather examining the system first hand. A fast overview of the system is very important for me.

1.1	Do you think the actual effort on Documentation resembles its importance in professional practice in your organization?	No – our projects are not complex enough, saying that a lot of the things we do is “standardized” and customers are not willing to pay documentation of the customizing of a “standard” software.
1.2	Would you say that “overdocumentation” is possible?	Definitive yes, you can see it that sometimes there are documents in which one does not find the information in appropriate time, it is hard to find one´s way around a 60 pages plain word document in prose. Also the documentation of obvious pieces of information such as the operating systems specifications drag on the useability. Another point is that sometimes changing pieces of information such as “free space on hard drive” or operating system versions with service pack numbers are documented. These are never up-to date and therefore decrease the reliability, apart from that it often makes no sense at all to document these things.
1.3	Do you know and/or make use of a scientific technique to determine the utility of documentation?	No, but there may be a way such as comparing the time required to get a certain piece of information. One could conduct an experiment with two service technicians, giving

		one the documentation to find it and let the other one examine the system. In the type of projects we handle I expect the latter to be faster a lot of the times. Apart from that of course some parts of documentation are also “required” for the systems acceptance test at the end of the project, there the benefit is that the test can only be positive if the documentation exists.
1.4	How do you / does your organisation determine the amount of documentation necessary for an IT project or System?	The projects I make the estimations for are not that extensive, often I only have to extend a system for one more use case. These projects range from 1 to 8 days normally and I plan one man-day for documentation for all projects. This is enough for the big ones and for the smaller ones it just is the smallest possible unit, which can be explained to the customers quite easily. This pattern I evolved over time and found that it fits nearly 90% of the projects very good.

Part 2 – Expert interviews results

Following are the results of the second expert interview conducted.

Interview A2

Company Profile	
Branch of Industry	Pharmaceutical Research
Country of Operations	Germany
Job description of interviewee	Quality assurance representative
Years of experience in IT project management	10 years / part time

	Date of the interview: 01.07.2014	
2.0	Are you satisfied with the overall quality and amount of documentation you receive from external service providers (i.e. system integrators, Software developers) ?	It happens that the inspection of the delivered documentation reveals weaknesses that we have to object to. Increasingly this is occuring when a project is given to service providers on a fixed-rate basis. The problem is that we can only describe the documentation needed in the form of what documents are mandatory. We can for example put into the projects specifications that an installation procedure documentation is mandatory, to be able to reconstruct the system in desaster recovery. However ther is no suitable measurement on how extensive that has to be and what quality it must have. Therefore the service providers keep it to the bare minimum, which is to save costs of course, and we might have to dismiss the first draft and urge for refinement.
2.1	Please give the 3 most important and/or meaningful quality criterias for IT Documentation.	Completeness, correctness, understandabilty
2.2	Please rate the following quality criterias in school grading from 1 most important to 6 least important	
	Completeness, readability, correctness, audience directed, consistency, layout, ease of access, actuality, traceability, extendibility	Completeness - 1; readability – 3; correctness – 1; audience directed – 4; consistency – 2; layout – 3; ease of access – 3; actuality – 2; traceability – 4; extendibility – 5;

2.3	Do you/does your organisation assess the quality of documentation delivered from service providers?	Yes, the critical systems in terms of business critical and security critical are subject to an inspection before they go into production and have to go through annual auditing, mostly internal auditing but some also external auditing.

Interview B2

Company Profile	
Branch of Industry	Pharmaceutical Industry
Country of Operations	Switzerland, Germany
Job description of interviewee	Person responsible fo application management, Enterprise Content Management Systems
Years of experience in IT project management	26 years

	Date of the interview: 30.06.2014	
2.0	Are you satisfied with the overall quality and amount of documentation you receive from external service providers (i.e. system integrators, Software developers) ?	Generally I would say yes, most projects have a checklist to which documents have to be deliverd by the external service providers and we look over the documents delivered, to make sure their extent and quality is sufficient to our purposes.
2.1	Please give the 3 most important and/or meaningful quality criterias for IT Documentation.	Correctness, Actuality, Thoroughness
2.2	Please rate the following quality criterias in school grading from 1 most important to 6 least important	
	Completeness, readability, correctness, audience directed, consistency, layout, ease of access, actuality, traceability, extendibility	Completeness - 2; readability – 1; correctness – 1; audience directed – 5; consistency – 2; layout – 4; ease of access – 4; actuality – 2; traceability – 4; extendibility – 6;
2.3	Do you/does your organisation assess the quality of documentation delivered	Yes.

	from service providers?	

Interview C2

Company Profile	
Branch of Industry	IT Consulting (former inhouse IT for housing cooperative)
Country of Operations	Austria
Job description of interviewee	Senior software developer and project manager
Years of experience in IT project management	15 years

	Date of the interview: 30.06.2014	
2.0	Are you satisfied with the overall quality and amount of documentation you receive from external service providers (i.e. system integrators, Software developers) ?	For the most part we do not assess the quality of documentation we receive. Therefore it is hard to answer the question, but considering how our service-desk team thinks about it we can not be very satisfied with the documentation we have.
2.1	Please give the 3 most important and/or meaningful quality criterias for IT Documentation.	Readability, Correctness, Actuality
2.2	Please rate the following quality criterias in school grading from 1 most important to 6 least important	
	Completeness, readability, correctness, audience directed, consistency, layout, ease of access, actuality, traceability, extendibility	Completeness - 2; readability – 1; correctness – 1; audience directed – 4; consistency – 4; layout – 6; ease of access – 2; actuality – 1; traceability – 5; extendibility – 6;
2.3	Do you/does your organisation assess the quality of documentation delivered from service providers?	No, there is no standard procedure for that. Of course the project manager is responsible for getting all that was ordered in the right quality, but mostly a quick going-through the documentation is all we do.

Interview D2

Company Profile	
Branch of Industry	IT Consulting
Country of Operations	Germany, Austria, Switzerland
Job description of interviewee	Senior Consultant and project manager
Years of experience in IT project management	19 years

	Date of the interview: 30.06.2014	
2.0	Are you satisfied with the overall quality and amount of documentation you receive from external service providers (i.e. system integrators, Software developers) ?	When we deliver documentation to the customer I mostly do not get any feedback on it. When I search information on a project in the according documentation I sometimes think that a lot of the information recorded is not very useful at all and just makes finding the bits I need more difficult.
2.1	Please give the 3 most important and/or meaningful quality criterias for IT Documentation.	Correctness, Accessibility, extendability - especially the extendability is a problem in systems maintenance, just shortly I took over a project to which there only was a printed out version of the documentation available, this made it merely “unchangeable” and therefore the information was not up-to-date any more. We had to recreate the documents which was a lot of effort.
2.2	Please rate the following quality criterias in school grading from 1 most important to 6 least important	
	Completeness, readability, correctness, audience directed, consistency, layout, ease of access, actuality, traceability, extendibility	Completeness - 1; readability – 2; correctness – 1; audience directed – 3; consistency – 3; layout – 3; ease of access – 1; actuality – 1; traceability – 6; extendibility – 1;
2.3	Do you/does your organisation assess the quality of documentation delivered from service providers?	Before delivering a documentation I often go through it with al collegue to check wether all the important information is included.

Interview E2

Company Profile	
Branch of Industry	IT Consulting
Country of Operations	Germany, Austria, Switzerland
Job description of interviewee	Senior Technical Consultant
Years of experience in IT project management	15 years

	Date of the interview: 30.06.2014	
2.0	Are you satisfied with the overall quality and amount of documentation you receive from external service providers (i.e. system integrators, Software developers) ?	The documentations we deliver to our customers have two parts, first is the user documentation that enables the users to work with the software, this part mostly satisfies. Second part is the technical documentation, this is only useful for persons that have experience with the systems involved. Therefore a collegue of mine or another service provider with expertise can take over from me. However for the customer this part is mostly useless, but it leaves the possibility to change the external service provider if needed.
2.1	Please give the 3 most important and/or meaningful quality criterias for IT Documentation.	Completeness, clarity, actuality - and also very important is the „findability“ saying that the information needed has to be findable in the documents and also the documentation as a whole has to be made accessible to all possible persons to need it.
2.2	Please rate the following quality criterias in school grading from 1 most important to 6 least important	
	Completeness, readability, correctness, audience directed, consistency, layout, ease of access, actuality, traceability,	Completeness - 3; readability – 2; correctness – 1; audience directed – 5; consistency – 3; layout – 2; ease of access – 1; actuality – 2; traceability –

	extendibility	6; extendibility – 5;
2.3	Do you/does your organisation assess the quality of documentation delivered from service providers?	The documentation we as a third-party service provider deliver to the customer is not assessed in 99% of times. Mostly it gets archived somewhere and the point on the checklist is checked.

Ranking of the quality criteria

	A2	B2	C2	D2	E2	Average
Completeness	1	2	2	1	3	1,8
Readability	3	1	1	2	2	1,8
Correctness	**1**	**1**	**1**	**1**	**1**	**1**
audience directed	4	5	4	3	5	4,2
Consistency	2	2	4	3	3	2,8
Layout	3	4	6	3	2	3,6
Ease of access	3	4	2	1	1	2,2
Actuality	2	2	1	1	2	1,6
Traceability	4	4	5	6	6	5
Extendibility	5	6	6	1	5	4,6

Table 1 - Ranking of documentation quality criteria

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Abbreviations

IT	Information Technology
KPI	Key Performance Indicator
GOB	specific “Generally Accepted Accounting Principles” for Germany
GAAP	Generally Accepted Accounting Principles (i.e. for the USA)
ISO 9001	Standard of the International Organization for Standardization (ISO) concerning: Quality management systems — Requirements
IDW 330	also called IDW PS 330 is a guideline of the german „Institut der Wirtschaftsprüfer“ to support the annual accounting audit with use of information systems (Abschlussprüfung bei Einsatz von Informationstechnologie)
AktG	regulations for stock-corporations in Germany (“Aktiengesetz”)
HGB	general regulations for companies and merchants in Germany (“Handelsgesetzbuch”)
AO	regulations concerning tax-related issues for companies in Germany (“Abgabenordnung”)
BSI	Federal Office for Information Security that creates norms and standards for information security in Germany (“Bundesamt für Sicherheit in der Informationstechnik”)
COBIT	Control Objectives for Information and Related Technology; Framework for the governance and management of information technology in enterprises by ISACA
ISACA	Information Systems Audit and Control Association (ISACA)
ITIL	Information Technology Infrastructure Library (ITIL); a set of Best-Practices for aligning IT strategies with business needs
IEEE	Institute of Electrical and Electronics Engineers – worldwide association of IT professionals

Affidavit

I hereby declare that I wrote this paper on my own and without the use of any other than the cited sources and tools and that all material that I copied directly or used in any other way is marked as such. Further I declare that I have not submitted this paper in this or any similar form to any other commission for examination or any other purposes. I am aware of the fact that a misstatement may have serious legal consequences.

17.07.2014, Keltern	Daniel Brenk
_____	_____
Date, Place	Signature