

Siemens AG, Germany

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(DIN German Institute for Standardization)

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12.1 Introduction

This study is an evaluation of the economic benefits of the use of standards by industry carried out following the ISO methodology, in collaboration with the switch technology and standardization divisions of Siemens AG, Germany. The main focus was on the DIN EN 62271 standards series, which are essential for the switch technology sector. Standardization in the industrial environment is often regarded as a concrete financial burden of uncertain benefit, an attitude based on a cost accounting point of view. While there is a concrete cost centre for "standardization", there are no profit centres with the same designation on the opposite side of the balance sheet. Indeed, in contrast to the evident costs of standardization, it is often difficult to identify the resulting profit.

This could, among other things, be because standards are often used to prevent costs from occurring in the first place, for example, by creating contractual and legal security. In addition, the advantage of using standards only becomes apparent through their application in a particular business function. Thus, the resulting advantage is often regarded as an achievement of the organization's departments which implement the standards. Here the ISO methodology comes into play, as it tries to crystallize and aggregate the advantages gained in individual business functions through standardization, with the result that an accumulated virtual balance sheet entry "benefits of standardization" can be created once the methodology is applied.

This study not only focuses on the application of the ISO methodology, but also on any difficulties which might occur, and on any changes and adjustments which need to be made to the implementation and evaluation of the methodology. This will especially help in improving

it further, making it more user-friendly and less complicated for use in the industrial environment.

Since the economic benefits of standards do not only depend on their content but also on their applicability, an empirical study of the perception of the usefulness of extensive industrial standards was suggested by Siemens as well.

12.2 Standardization policy at Siemens

Siemens has long and extensive experience of standardization. The company regards standardization as very important for its success and has an entire department dedicated to this subject. At Siemens various standards are used in production, for price optimization and for compliance. Beyond that, great value is attached to participation in standards committees, which is seen as an important tool for ensuring a competitive, future-oriented product portfolio.

Within the remit of this analysis, it was evident that the standardization concept is actually very widespread and, as a rule, it is rare for the benefits of standardization to be questioned.

12.3 Introducing the ISO methodology

The ISO methodology is a methodological approach used to systematically analyze – taking Porter’s value chain as a starting point – the individual value creation stages within a company or even an entire industrial sector with respect to the economic impacts of standards. This method is intended for investigations into the impact of standards on value creation within a business. The idea of such an investigation is not new. For example, as early as 1990 DIN published a technical

report on “Ways of calculating the success of standards projects”¹. Admittedly, the separate consideration of each value creation stage is a considerable improvement on the earlier approach because it makes the identification of the impacts of standards more structured and more comprehensible.

The method is based predominantly on surveys of technical experts and standardization experts inside the company. On the basis of these interviews, an attempt is made, using a detailed, step-by-step plan, to localize and substantiate each potential source of the benefits to be gained from standards.

The individual steps of the methodology are²

- Analysis of the value creation chain
- Identifying value drivers
- Identifying the impacts of standards
- Data evaluation and aggregation.

12.4 Application of the ISO methodology

12.4.1 Analysis of the value chain

12.4.1.1 Value chain of the industry

First, the position of the switch technology sector considered in this study is determined within the overall industrial context (**Figure 1**). As inferred by the name “energy” given to this Siemens sector, switch technology is part of the larger energy technology sector, and within the electricity supply value chain, which involves essential components for the transport and distribution of electrical energy for uses

1 DIN (1990)

2 ISO, Roland Berger (2010)

ranging from high-voltage circuit breakers in transformer stations to low-voltage switchgear in a building.



Figure 1 Value chain for electricity³

12.4.1.2 Value chain at Siemens

In Siemens’ switch technology sector there is a conventional value chain, presented in the form introduced by Porter (see **Figure 2**).⁴

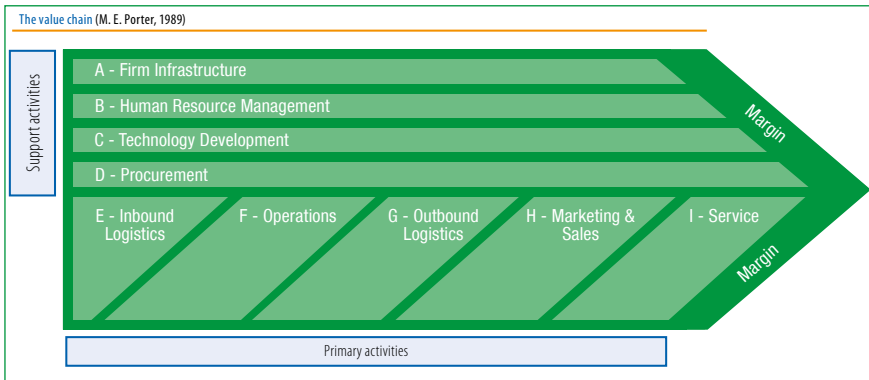


Figure 2 Value chain according to Porter⁵

³ Winje D. (2009)

⁴ Michael E. Porter (1989)

⁵ Michael E. Porter (1989)

12.4.1.3 Areas of value creation

It is important to bear in mind that switch devices and installations may be complex, but they represent a mature technology that brings little in the way of new logistic or operational demands. Thus the changes made over the past few years predominantly relate to the optimization of functions and improving the efficiency of the switches. This and the observation that Siemens has managed to retain its market position not by competing on price but by maintaining a high technical standard has resulted in the analysis being focused on the development and market preparation of the switch products (**Figure 3**).

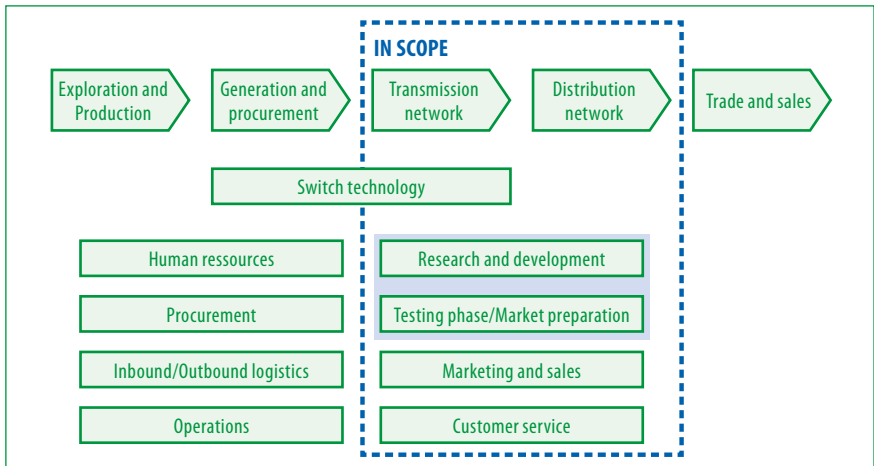


Figure 3 Value creation areas (author's representation)

12.4.2 Identification of value drivers

The search for value drivers was based on numerous conversations with employees, on the joint analysis of the market, and on the positioning of Siemens AG in this market. It became clear that many other

intangible values also play a major role, for example, maintaining a good reputation over many years and the image of a manufacturer demanding the highest quality. The value drivers identified are listed below :

- Improving product efficiency
- Cost-effective further development of the product portfolio
- Products which cover a wide spectrum of customer needs, with emphasis on extremely demanding systems
- Future-oriented technology
- Above-average quality and reliability of switches and switchgear
- Tests and inspections which go beyond the requirements of the standard to substantiate an above-average quality
- Capitalizing on long experience and maintaining a good reputation.

12.4.3 Identification of the impacts of standards

After the first few interviews with switch technology employees it became clear that it would not be possible to apply the methodology without modifications. This is mainly because switches and switchgear are products that cannot be sold if they do not meet the relevant standards. Furthermore, these standards have generally existed for decades so it was not possible to establish the benefits by comparing the situation before the standards were introduced or make comparisons with competitors who do not use them. One approach is to consider the regular revision of the relevant standards and to see whether added value has been created for Siemens through these revisions, and whether this added value benefits all companies in the sector to the same extent.

12.4.3.1 Standards relevant to switch technology

The essential standard series for switch technology is DIN EN 62271, *High-voltage switchgear and controlgear*. The following standards are of particular relevance to the sector:

- DIN EN 62271-1, *Common specifications*
- DIN EN 62271-100, *Alternating current circuit-breakers*
- DIN EN 62271-200, *AC metal-enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV*
- DIN EN 62271-203, *Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV.*

The modifications to these standards over the past few years were investigated as regards their potential monetary impacts.

12.4.3.2 Indicators for identifying the impact of standards

Indicators help to clarify the often complicated relationship between the changes made to the standards and the company's success, particularly on the basis of the value drivers identified. To make this connection clear, it must be possible for the indicators to be influenced by a standard and they must have a direct impact on the company.

A list of indicators which meet these criteria is given below:

- Changes to the procedures for developing and approving switches
- Changes to the technical requirements for switches and switchgear
- Changes to quality and service requirements
- Changes to recommended and mandatory values
- Care should be taken to determine if the following indicators apply:
 - The change to the standard affects a criterion relevant to tendering
 - Changes to the standard do not equally affect all market participants

- The cost to Siemens or other market participants for implementing the changes
- The extent of the actions needed as a result of the changes (e.g. on the basis of costs incurred/savings made, or matters which have a bearing on employees affected by the changes).

12.4.3.3 Potential impact of changes to standards on company success

Siemens switch technology experts with special knowledge of each standard listed in 12.4.3.1 were consulted. Correlations between the value drivers and indicators given above were investigated. Potential changes to DIN EN 62271-100 and DIN EN 62271-203 that would benefit Siemens became especially evident, although only a few changes seemed likely to have a direct positive impact on the success of the business. With many of the changes, an influence on the market as a whole could be expected, and could affect the performance of the company in complex ways.

Changes to the standards are stated below, assigned to one of three categories according to its impact. In each case there is a short explanation of the changes in the standard, and their connection with Siemens and the market is described in the full version of this study.

- **Direct positive impacts:**
(Savings or profits are the direct result of applying the changed standard)
 1. DIN EN 62271-100, Chapter 6.111 – Capacitive current switching tests, combination of tests
 2. DIN EN 62271-203 – Harmonization of the standard with US standard IEEE 37.122 (on-going)

3. DIN EN 62271-203, Chapter 8.1 – Recommended voltage levels.

- **Indirect positive impacts :**

(Savings or profits result from competitors having problems implementing the changed standard)

4. DIN EN 62271-100, Chapter 4.101 – Examination of different DC time constants

5. DIN EN 62271-100, Chapter 6.2.11 – Voltage test as a condition check

6. DIN EN 62271-100, Chapter 6.101.1.1 – Characteristic performance curves of drive units

7. DIN EN 62271-100, Chapter 6.111 – Capacitive current switches, reclassification

8. DIN EN 62271-203, Annex F – Service Continuity

9. DIN EN 62271-203, Chapter 12 – Environmental aspects

- **Impacts which cannot be attributed to a particular change :**

1. Anticipation and consideration of potential future changes to standards in the development and design of switching products

2. Participation in standards committees.

12.4.4 Evaluation and aggregation

The impacts stated in 12.4.3.3. were evaluated quantitatively. First, each impact was considered separately and the financial impacts gained from it were quantified with the help of the relevant experts. Where figures were not available, qualified estimates were made and bundled together with any impacts having similar value drivers/indicator-combinations in order to obtain a broader basis of indices for a reliable estimate.

With many impacts or impact groups, the data available are not sufficient to attribute a specific value to the established outcomes. Therefore, where there is no certainty about the values, calculations of maximum and minimum outcome are given. Thus one can be confident of finding the true value in the interval between the two. As confidential internal company figures were used to quantify the financial benefits of individual impacts, the calculation is not dealt with in detail here. The cumulated benefit from all impacts on the EBIT adds up to between 1.1 % and 2.8% and is discussed in the following section.

12.5 Evaluation of the results of the ISO methodology

12.5.1 General evaluation of results

During the study it was often not easy to identify the necessary values, with the result that most are based on expert estimations. This was also the reason why the result is given in terms of intervals. However, at no time was the work conducted with unfounded or vague data, so that it is justifiable to claim that the data used for the methodology is reliable. Nevertheless, the result cannot be expressed in the form of a direct numerical value as a tangible benefit. Rather, it is a matter of observing if there is an impact at all and estimating whether this impact will lead to a constant value.

In carrying out the ISO methodology, an impact of the use of standards on the EBIT of the Siemens sectors under consideration was found to be roughly between 1.1 % to 2.8 %.

To further evaluate these results, the following specific boundary conditions of the study should be considered :

- We are not dealing with the benefits of applying new standards, but only with the benefits of minor changes to an established standard. The benefits gained from a new standard can be considerably greater, especially in areas that have not been standardized
- To make a plausible evaluation of the benefits from the observed impacts of the changes to the standards, the lowest values were always estimated in cases of doubt
- Three chronologically and thematically independent new editions of existing standards from the switch technology sector were considered
- Since the objective of the study was to demonstrate the benefits of applying standards in the switch technology sector of Siemens AG, attention was directed towards the positive impacts of standards in this explicit case. The impacts used, especially the indirect ones, could also have negative implications for other companies
- There was no detailed investigation as to whether the changes to the standards might also have caused negative impacts. Because of Siemens AG's active participation in the standardization process, it can be assumed that such negative consequences were kept to a minimum and did not affect the benefit gained by the new editions of the standards.

After considering the boundary conditions it is possible to conclude that the observed positive impact is well-founded. The conservative estimate of 1.1 % highlights a feature of this positive impact that cannot be explained only in terms of disturbing influences and random variations in the market.

Due to the unique boundary conditions, this impact cannot be automatically applied to other companies. Only if further studies carried

out using the ISO methodology bring similar results could a general characterization prove to be true.

Yet even this single result is an important indication that companies should consider in their dealings with standardization, and in investigating the potential economic advantages of standards and standardization. The existence of potentials alone is not sufficient to realize economic benefits, as seen in our consideration of Siemens switch technology.

12.5.2 Evaluation of the results of the study from the Siemens AG perspective

Siemens AG already has a distinct standards culture and standardization as a whole is taken very seriously. The company is very active in the use of standards and in participation in standards projects, and this clearly pays. In all sectors considered, products were well prepared for changes currently taking place so that no unexpected tasks or costs arose when the standards were finally updated. Often it was even possible to profit from the revision of the standard.

However, there were also areas in which a potentially available benefit could not be made use of economically. Specifically, there were potentials resulting from stricter test requirements based also on the fact that competitors could not easily fulfil the new requirements (indirect positive impacts 2 to 4 in 12.4.3.3). It is therefore important that a further analysis be carried out to investigate how information about quality can be communicated to the market so that the potential described above can, at least in part, be realized.

Furthermore, it is important to communicate the conclusions of the study to ensure that the proactive involvement in standardization, which has led to positive results, will continue in future as well.

12.6 Experience of using the ISO methodology and suggestions for modifications

The following addresses the experiences gained from applying the ISO methodology and the associated tools. In particular, we take a close look at difficulties that occurred and the resulting adaptations. Where possible, suggestions are made about potential measures for modifying the methodology to make it even more comprehensible and easy to use in future.

12.6.1 Getting to know the ISO methodology

The methodology is described in detail in many different documents and is illustrated with good, but sometimes too simplified, examples of its use in practice. The many almost identical documents hamper the process of familiarization with the methodology and can result in misunderstandings. Nevertheless, one quickly gains an understanding of the consistent and systematic procedures.

12.6.2 Application of the ISO methodology

It is apparent that the methodology is best suited to an established traditional manufacturing company which replenishes or updates its standards portfolio at regular intervals. If, however, the company being investigated departs from these assumptions, difficulties are encountered relatively quickly when carrying out the prescribed steps of the process.

Section 12.6.4 discusses measures to help make the ISO methodology more flexible, efficient and user-friendly.

12.6.3 The tools of the ISO methodology

In the methodology toolbox are many documents that, in theory, provide graphics, schemata and questionnaires for every phase of the analysis. It also provides advice on identifying and quantifying the potential impacts of standardization, and evaluation tables.

The tools are strictly oriented towards an ideal course of procedure. As soon as the procedure deviates from the prescribed methodology (for example, for the reasons stated under 12.6.2), many of the tools could no longer be used in the given form, and it was often easier to devise a special tool for the problem at hand than to modify the existing tool. The tools often gave the impression that the investigation should be conducted as broadly as possible (across an entire company or industry sector) which would be at the expense of a more precise, in-depth study of the benefits of standardization in specific areas.

12.6.4 Suggestions for modifications of the ISO methodology

- The ISO methodology and tools should be available in the local language of the company in question, especially for small and medium-sized companies.
- Various versions of the original methodology and tools should be available, which should depend on elementary criteria of the companies under consideration. Possible criteria would be:
 - Whether a company, a company department, or a sector is being considered
 - Whether the relevant standards are applied voluntarily or are mandatory
 - Whether the subject is a private, state-run, or partly-privatized company

- What constitutes the company's or department's principal means of creating value: manufacturing, services or idea engineering?
- It should be possible to sub-divide the identified impacts of standardization into theoretical impacts and realizable impacts, if needed.
- Depending on the figures obtained, the evaluation should aim at obtaining either a specific value or a specific interval as its result.
- Where a company is not prepared to provide information about costs, profits, etc., it would be useful to have an alternative (for example, an algorithm) to enable the study to work in the absence of absolute numerical values without distorting the results. Such an option is important, because in the earlier DIN study of the economic benefits of standardization, only 9% of companies involved were prepared to give cost information⁶.

12.7 Conclusions

It is largely recognized that standards and standardization are an important economic factor. However, in the past this recognition was based on many isolated observations, theoretical principles and individual experiences. Using the ISO methodology, this study has demonstrated the clear positive economic benefit to be gained from the application of standards. Admittedly, the figure quantifying the minimum benefit from standards, approximately 1.1% of the EBIT, is not a value with universal validity that can be applied to all other companies, but it is nevertheless an outcome that supports the benefits of standards.

⁶ DIN (2000)

While implementing the methodology, a few difficulties occurred due to the fact that the methodology is formulated in relatively strict and inflexible terms. However it was always possible to circumvent these difficulties by reflecting on the basic idea of the methodology and using a little creative effort. Modifications were suggested in order to make it simpler, more flexible and easier to understand in future.

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