UNION FENOSA QUALITY MANAGEMENT SYSTEM FOR NETWORKS OVER 20 kV

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INTRODUCTION

Foundations and contents of the Unión Fenosa Quality Management System for networks over 20 kV , (SCT), are presented in this paper.

QUALITY AND TRANSACTION COSTS

ISO 9000-compliant quality assurance systems are systems whose definitions of conditions and characteristics are to be found in standards; it may, then, prove to be useful to review some of the concepts addressed in the economics of standardisation to infer the benefits to be gained from using such systems.

Beginning in the 50's, standardisation gradually ceased to be considered in a purely technical light, as attention turned to its economic implications as well. The economics of standardisation falls in the domain of the economics of information; the establishment of standards is of greatest importance when economic agents are unable to assimilate all the relevant information on goods purchased from other agents, except at a very high cost.

Standardisation facilitates commercial transactions involving substantial transaction costs, to obtain information on specifications or characteristics of a given product or service. Standards would, then, be arrangements designed to facilitate communication within an industry. It has in fact been proved that the use of standards lowers business transaction costs.

The economics of transaction costs postulates that such costs arise in a company when interchange becomes frequent, ambiguous or too complex to be perfected by the market. Such situations are the result of a specific combination of human factors and environmental conditions.

Of the human factors, bounded rationality refers to the fact that whereas microeconomics postulate that the agents involved in market transactions are perfectly aware of its workings and conduct their business in a way that maximises some utility function, the agents involved in transactions described by transaction cost economics either incur expense to obtain additional information or simply make decisions (transaction options) on the grounds of incomplete knowledge. The presumption of opportunism is also taken from classical economics theory because in transaction cost economics, actors are not dispassionate beings solely concerned with maximising utility, but rather shrewd individuals who seek their own benefit at the expense of those with whom they conduct business. The combined effect of bounded rationality and opportunism is that the actors realise that their knowledge is limited, that the people with whom they do business cannot be trusted and that any attempt to mitigate these factors involves expense, i.e., transaction costs.

Environmental factors come under the domain of the transactions themselves, as opposed to the motives or characteristics of trade partners. Uncertainty, for instance, refers to the fact that circumstances change unpredictably and that such changes may be to the economic detriment of the agents currently engaged in a business transaction.

Uncertainty is to be distinguished from bounded rationality because whereas the latter may be reduced by devoting greater effort or incurring greater expense, the former, by its very nature, can never be eliminated.

Asset idiosyncrasy refers to the extent to which resources devoted to a given transaction cannot be used for others. Exchange frequency is simply the number of times that an exchange occurs.

The above definitions are artificial in a way, because transaction costs cannot be understood outside the context in which they occur and the combined characteristics of the agents involved in the transaction and the environment in which it takes place are what ultimately determine the context. The risk of opportunistic behaviour, also more neutrally termed strategic behaviour, is higher, then, when the idiosyncrasy of the assets at stake is very high; and the impact of bounded rationality, in terms of the truth and accuracy of the information exchanged and the reliability of the agents, decreases as transaction frequency increases and direct experience provides further information on the trading partner's honesty and efficiency.

Transaction costs, in brief, are often described as the cost of:

- compiling and assimilating information,
- planning and developing proposals,
- negotiating and formalising contracts,
- counselling and creating an environment,
- inspection fees,
- "lobbying",
- etc.

From the accounting standpoint, such costs are not usually charged to a specific budgetary item, but rather are included as overhead. Recognition of patterns in transaction cost behaviour improves cost control, alerting the company to where the underlying causes of such costs lie (uncertainty, opportunism, etc.). But the establishment of management techniques based on the economics of information, such as quality management techniques, helps to lower such costs.

EFFICIENCY AND ELECTRICITY INDUSTRY RESTRUCTURING

The electricity industry is in the midst of a complex process of restructuring and transition to competition, essentially in pursuit of greater efficiency. When we speak of improved efficiency in the electricity industry, we must distinguish between economic efficiency and energy efficiency. The former, in turn, may be broken down into allocative efficiency, X-efficiency and dynamic efficiency. The latter is related to the industry's environmental impact.

To reach allocative efficiency companies must use the best possible combination of inputs to produce a given volume of outputs at the lowest possible cost. Marginal productivity theory tells us that in a perfect market such efficiency is reached when prices are equal to marginal costs. The market is then said to be in balance and allocation of resources optimum. Product prices based on this equivalence are instrumental to the remuneration of production factors.

The introduction of quality management systems in the electricity industry contributes to pricing that reflects the actual cost of power, which is one of the aims of restructuring.

X- or static efficiency is defined to be a company's capacity to produce a given amount of goods and services using a given combination of inputs, which minimise total cost. A company that is operating inefficiently may produce more by simply improving the use it makes of the combination of the inputs employed. To the extent that companies do not produce to maximum X-efficiency levels, both society and firms lose out on the potential benefits of increasing outputs at no additional cost.

X-efficiency is also known, in regulated industries, such as in the present case, as a specific case of the principal-agent problem. Actually a vast field open to economic analysis, this problem addresses such questions as information asymmetry between a "principal" (regulator), which wants something to be done, and an "agent" (utility management), which must actually do it. When applied to X-inefficiency, the "principal-agent" problem mirrors the lack of understanding on the part of the regulator about the optimum level of effort and resources used by the regulated company.

New regulatory incentive schemes applied to the residual monopoly (transmission and distribution) are typically based on a formula consisting of two parts; one in which the incentive is provided by the competitive nature of the market and the other which rewards utility behaviour geared to regulator aims.

$$\text{REVENUES}_{\text{YEAR N}} = \text{REVENUES}_{\text{YEAR(N-1)}}\ (\text{CPI-X}) - \text{QUALITY}\ (\pm)\ \text{A's}(\pm)\ \text{Z's}$$

The first member of the formula above includes the well-known term "consumer price index less X" (CPI-X). X is the factor applied by the regulator to compensate its information asymmetries with respect to the regulated utility. It is known as the productivity factor because it is designed as an incentive for the utility to reduce costs to compensate for rent extraction occasioned by application of the X factor by regulators.

Implementation by the utility of a quality management system that provides for the co-existence of models to cut costs on the one hand and increase revenues on the other, as conceived under Quality Management Systems based on Continuous Improvement, would obviously lead to offsetting the revenue losses to which it may be subject in this regard.

Dynamic efficiency is a company's increase in productivity or heightened capacity to create value from certain resources as a result of innovation. In other words, it is the company's ability to make investments to lower costs or raise revenues (e.g., research, implementation of new technologies, process re-engineering, etc.) thereby leading to the production of more competitive goods and services.

The improvement in dynamic efficiency through the incorporation of new technologies and management models such as Quality Management Systems based on Continuous Improvement not only consolidate the long-term lowering of unit production costs, which together with competitive pricing contributes to lower consumer prices, but also increases the utility's ability to create value by introducing improvements in the quality and variety of the goods and service offered.

Finally, from the environmental standpoint, quality is obviously seen as a duty of Supply-side agents (the ones involved in the production of goods and services) and a right of Demand-side agents (consumers).

TRANSACTION COSTS IN THE NEW RESTRUCTURED ELECTRICITY INDUSTRY

Economic relations that are not governed by company command and internal control systems must be subject to some kind of commercial arrangements. Most business conducted in the electricity industry prior to restructuring took place inside the electricity utilities. The unbundling of generation, transmission and distribution that restructuring entails calls for a greater reliance on commercial contracts by utilities and consumers both.

To understand this, we should consider that whereas a vertically integrated electricity utility builds and operates its installations and generation, transmission and distribution equipment, in a decentralised system, the financial and physical interrelations deriving from these activities must be governed by contracts. Financial relations are contracts between the Distributor and its suppliers (including generating utilities) or its customers. Physical interrelations refer to the terms of the contract specifying which agents are physically in control of the distribution system. A distributor, for instance, may negotiate access to its own grid by a self-producer for twenty years.

Moreover, restructuring gives rise to new options on the retail market to broaden the range of consumer choice. For customers, taking advantage of such opportunities involves making an effort to learn, assess and choose; i.e., what we have called transaction costs. If these are too high, some options may fall by the wayside. Certain options will entail greater risk for some customers than for others, or may only be open to a certain kind of customer. For the distributor, competing for customers means introducing both technological and cultural changes in its business: changes in strategy to seek more efficient use of resources.

NEW STANDARDISATION NEEDS

Standardisation has primarily been organised around materials. This has been due essentially to historic reasons, namely, the need to avoid the risk of the proliferation of different kinds of components that arises with new technologies and leads to problems of interchangeability.

In the immediate future, with the functional unbundling of the industry on the one hand and the intensive application of electronics and information technologies, which afford higher and higher degrees of integration of elements, functions and processes, on the other, the practicality of that approach will not be readily defensible. A standardisation system is needed that solves not only problems of compatibility between materials, but of compatibility with other systems.

A (transmission and distribution) utility's needs are defined in terms of grid control and overall availability. System availability no longer depends only on the availability of each of its components, but also on the consistency between specifications and the definition of interfaces with other systems, to reduce the transaction costs that may arise. That is to say, a need is felt for an external conceptual network able to solve problems of compatibility between the utility, its customers and its suppliers: definitions, characteristics, service terms, building techniques, installation procedures, etc.

Some of the elements involved in ensuring such consistency are:

- technical and functional specifications,
- reliability: tests, quality control, etc.
- maintenance: periods, ranges, replacement part management, etc,
- staff safety,
- relations with the environment,
- interfaces between control equipment and disconnection elements,
- interfaces between remote control and control systems,

In this context, Quality Management Systems have obvious cost-reduction potential for frequent, simple, safe transactions with low levels of associated investment idiosyncrasy.

QUALITY REGULATION

A monopoly has two incentives to pursue quality: sales and prestige. When quality is observable by consumers prior to purchase ("search good"), lower quality means fewer sales and therefore less revenue when the price is higher than marginal costs. By contrast, when quality is only observable by consumers after purchase ("experience good"), the monopoly has no incentive to improve quality unless consumers are able to repeat purchase in the future. In this case, the incentives to provide a quality product or service clash with the pursuit of lower costs and quality hinges on the monopoly's desire to maintain its prestige and conserve future profits.

A distinction must be made between observable and verifiable quality:

* Normally, the quality of a good or service is observable before or after consumers purchase it.
* The quality of a good or service is verifiable when, at no cost, a certain level of quality for a good or service may be established ex-ante in a contract and ascertained in court ex-post.

When quality is verifiable the regulator may impose a quality objective for the regulated firm, or more generally, reward or punish it in terms of quality levels achieved.

The distinction between verifiable and non-verifiable quality is immense. More generally speaking, quality may be thought to be verifiable at a cost. It would then be worth while to have a measuring system to analyse the relationship between the expense entailed to measure quality, the interests linking quality to prestige and the ability of the regulatory scheme applied to the electricity utility to determine its revenues. Regulatory schemes applied to electricity utilities have not yet achieved this level of refinement, but if they adopt management techniques based on Total Quality, and implement measuring systems such as the European EFQM self-assessment model, they may be able to reach it in the future.

DISTRIBUTION QUALITY APPROACH

Under the circumstances prevailing at this time in the electricity industry, the so-called "Third Party Approach", which focuses on the role of specialised Organisations essentially independent of both the manufacturer or supplier (First Party) and the buyer or user (Second Party) seems to be the most suitable way to meet electricity utility needs.

Its main advantages may be summarised as follows:

(1)It is better adapted to the present scenario, characterised by growing demand for quality by users, increasingly complex technologies and associated quality processes, market globalisation and the tendency to outsource activities that are not strictly related to the electricity utility's core business.

(2) It does not entail any greater cultural or material dependence on the supplier for the electricity utility (which does occur, for instance, in the First Party Approach, which focuses on the manufacturer);

(3) It is less costly than the Second Party Approach, where the user takes the leading role.
(4) It reduces interference with innovation (the development of new products and improvement of existing products) which may, by contrast, be substantially constrained under some kinds of Second Party Approaches. Product innovation continues to be wholly incumbent on the manufacturer, while compliance with user requirements is in some way acknowledged by competent Third Party Operators.

(5) It furnishes the electricity utility reliable and accurate information about the capacity of a large number of potential suppliers (both at the national and international levels). This, in turn, provides for a broader range of choice thanks to qualification ratings based on different kinds of certificates issued by Third Party Operators (a result more difficult to achieve under the First and Second Party Approaches).

It is nonetheless true that the viability of the Third Party Approach is highly dependent upon the existence of effective national and supranational infrastructures for Quality and Certification, able to furnish recognition of substantial supplier compliance with electricity utilities' requisites and needs. Indeed, such structures are already in place in the major economic areas (i.e., European Union, North America, Japan and Oceania) and will soon be established in the rest of the world.

UNION FENOSA QUALITY SYSTEM FOR NETWORKS OVER 20 kV (SCT)

The organisation responsible for the network over 20 kV in Unión Fenosa is the SGT, whose mission is the reliable transmission of electricity from the input points where it is delivered by the Independent Network Operator to feeding points on the Medium and Low Voltage Network or to high voltage customers.

The implementation of the SCT is a team effort involving the entire SGT, which calls for the prior training of all its members to ensure that they acquire a sufficient understanding of how SCT Procedures affect the organisation's processes.

The SGT is responsible for Grid Planning, Building, Maintaining and Dispatching. Its functions include (1): Analysing potential network capacity and needs to guarantee reliability of supply, drawing up the necessary development and reinforcement plans. (2) Evaluating maximum grid capacity and determining the capacity available for commercial use. (3) Maintaining a Database of Installations comprising the network. (4) Establishing minimum requirements for fitting out the installations connected to the network. (5) Establishing operating and safety conditions for installations connected to the network and (6) Defining activity process procedures.

The SGT may require third party installations connected to the grid to meet established technical specifications and be put to proper use. Finally, the SGT must facilitate the use of the grid for the transmission of energy deriving from both the production market and provisions relating to grid access.

SCT COMPONENTS

The purpose of the SCT is to establish the procedures that in Unión Fenosa govern the processes involved in the above activity by adequately structuring and co-ordinating such processes, so all the respective variables are controllable and their outputs predictable and consistent. This meets the Crosby definition of Quality: "Quality is compliance with specifications".

Standard ISO 8402-86 defines the term Quality System as follows: "The organisational structure, responsibilities, procedures, processes and resources for implementing quality management ".

For the SGT this involves the definition and execution of a working method to comply with stipulated requirements. This method is approved and subsequently reflected in supporting documentation drafted for the SCT. The document structure adopted for the SCT is organised around two kinds of documents: Descriptive Manuals and Quality Records.

Descriptive Manuals are documents describing the SGT working method and are organised in terms of a three-tiered pyramid structure. At the top is the SGT Quality Manual, in the middle the SGT Procedures Manual and at the base the SGT Technical Specifications Manual.

Quality Records compile all formats and records used to execute the work performed by the SGT.

MANUAL OF GENERAL AND SPECIFIC PROCEDURES

This manual describes the general and specific procedures involved in the activities conducted by the SGT and required by the standard ISO 9000. This generic standard is geared to manufacturing industries. Certain aspects of organisations that provide services call for a slightly different approach. For the SCT to perform to standard, the correlation must be drawn between the procedures defining Unión Fenosa's processes and the procedures outlined in the reference standard. With respect to some elements of the standard this correlation is direct, but others require careful study.

The method followed to establish this correlation consists of analysing the differences to compare actual SGT practices to the requirements set out in the standard. This makes it possible to determine which elements are applicable and establish the structure and number of procedures based on

SGT processes. The advantage to this method is that it does not subordinate SGT structure to the standard, but rather, by articulating the SCT around present SGT practice, renders implementation more flexible and more responsive to change. This method differs from the usual *modus operandi*, which consists of structuring the processes of the organisation in question around the procedures laid down in the standard, subordinating the former to the latter.

SCT IMPLEMENTATION PLAN

The SCT Implementation Plan consists of a series of activities and a time frame in which they are to be conducted. This time frame is related to the "critical mass" (1) when implementation is initiated, to achieve sufficient "implementation inertia" to fuel SGT acceptance of the SCT and facilitate the development of all stages of the implementation process.

The advantages to this Implementation Plan are that (1) it allocates resources more suitably and efficiently, (2) it avoids unnecessary effort, (3) it avoids the "false starts" typical of unplanned action, (4) it stands as proof of the SGT members' commitment to the SCT, (5) it eliminates short-term visions and (6) it facilitates assessment of the SCT implementation process through completion.

The Implementation Plan is set out in an Implementation Manual, which also serves as a guideline of activities to be carried out. Furthermore, the Implementation Plan helps the SGT to: (1) adapt to the changes introduced by the SCT, (2) initiate the Procedures learning process, (3) acquire a view of the SGT from an outside perspective and (4) begin to acquire a more detailed understanding of how work is performed in the SGT.

IMPLEMENTATION MODEL

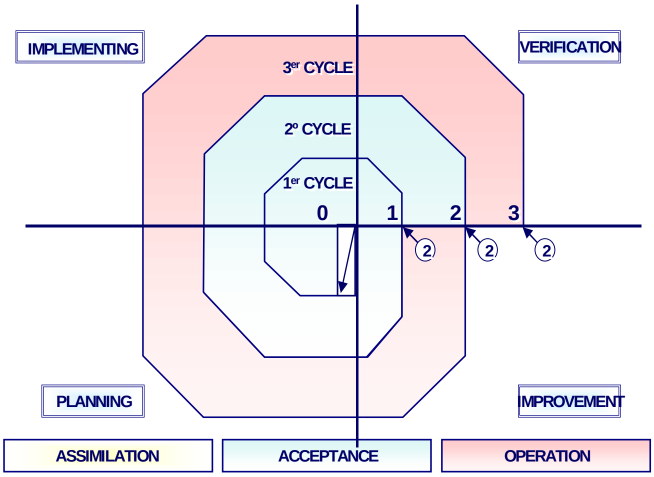

Figure 1

1 Critical Mass: "The people in an organisation with sufficient knowledge, power and leadership to initiate and sustain cultural change ". (Dockstader, Shumate & Doherty 1988).

Figure 1 illustrates the general structure of the model adopted to implement the SCT. In particular, it shows four quadrants associated with the "quality spiral" and the cycle corresponding to Deming's philosophy of Continuous Improvement, specifically adapted to the implementation process addressed here.

Implementation will entail completing three cycles in which both the understanding of the SCT to be implemented and the actual operation of the system steadily progress until the decision to apply for certification is made. Conventional operation of the SCT is achieved during the final spiral, when all the respective problems, uncertainties, etc. arising in previous stages have been solved. The use of the spiral suggests progress in the implementation of SCT with time and also denotes a gradual increase in the effort made.

The three cycles into which implementation is broken down are: Assimilation, Acceptance and Operation. Each of these consists of four basic activities that must be completed before undertaking the next implementation cycle: (1) Planning cycle implementation, (2) Cycle implementation, (3) Verification of results and (4) Amendments and improvements. A control point is inserted at the end of each of the three cycles. These points are designed to assess the work done and the results obtained during the cycle in order to decide whether to move on to the next cycle to continue system implementation or otherwise to specify under what circumstances such work should be continued.

The underlying intention in the model is to ensure that the most complex and critical aspects should be undertaken first, in the awareness that it is of little use to put less crucial parts in place if they are going to be subsequently modified or invalidated by more critical elements. It is for this reason that the most complex set of procedures that are most crucial to the success of implementation was chosen for the first cycle.

TRAINING

Quality creation is a labour-intensive activity, based on team work and, to a lesser extent, material investment. From the individual standpoint, SGT staff members will see the SCT and its Procedures from a perspective limited by the activities in which they are personally involved and from an angle defined by the part of the SGT in which they perform their duties (functional and geographic position).

Moreover, implementation of the SCT involves interaction among Unión Fenosa's various organisational units, some of which are sizeable. Each of these individuals' activities are related to the activities engaged in by the rest of the people in the unit; and at the same time the members of a given unit may perform very different tasks.

Each SGT staff member has a specific technical profile, in terms of his/her tasks and the know-how required to perform them. This technical profile also involves an exchange of information and co-operation with other Unión Fenosa staff, in the same or other units.

The implementation of the SCT affects technical profiles and alters the interchange of information and co-operation mechanisms in use prior to implementation. Under these circumstances each member of the SGT must acquire a more global vision of the SCT. This leads to flat implementation, whereby each person is afforded greater overall knowledge of the system, even though their specific SCT training focuses on the more technical aspects linked to their personal activity. This approach is in keeping with the flat design of standard ISO 9000.

In this connection SCT training is conceived to foster the ability to understand the new procedures implemented and goes beyond a mere technical knowledge of them. For this reason, training includes both technical and management aspects, while providing an overall view of the SCT that creates an environment propitious to acceptance. Such training features the following: (1) team training, (2) progressive training, (3) seamless training, (4) ongoing training and (5) training based on continuous improvement.

SCT MANAGEMENT STRUCTURE

When implementation of the SCT is initiated, participation should be handled from the highest level of responsibility in the SGT for two main reasons: (1) the substantial training required involves resource allocation and (2) the choice of procedures to be implemented during the first implementation cycle calls for decision-making at that level to ensure successful implementation of the system.

The decision and work teams created for implementation are the reflection of actual SGT practice. Implementation tasks are performed bearing in mind flows controlled by the SGT's hierarchical structure and monitoring the cross-process flows that cut across the organisation horizontally.

The highest management level is the SGT Steering Committee, the intermediate level is the Working Group and the lower level the Support Teams.

The SGT Steering Committee constitutes the SCT executive level and its membership consists of the Deputy General Manager of the SGT and the Heads of the Units under its aegis. This committee is responsible for SGT quality policy, planning and strategic management.

The Working Group comprises an interdisciplinary team consisting of one representative from each of the SGT units. This group is responsible for SCT development and implementation.

Support Team membership consists of one or several persons directly working on a process. Such teams answer to a Working Group, which they assist as needed, in terms of their know-how with regard to the operation of a process or the position they occupy in a process.

SUMMARY AND CONCLUSIONS

Quality Management Systems, as tools for rationalising production processes, enhance the electricity utility's economic efficiency by improving resource allocation and contribute to pricing electricity in a way that reflects costs, which is one of the primary aims of restructuring.

Quality Management Systems, to the extent that they foster compatibility, are able to cut costs and create "variety economies". They therefore constitute mechanisms that generate revenues and contribute to improving electricity utilities' X-efficiency by increasing margins and neutralising the impact of utilities' revenue loss owing to the application of the X productivity factor under regulatory schemes.

Quality Management Systems, which entail the introduction of new management technologies and methodologies, constitute a factor that enhances electricity utilities' dynamic efficiency and therefore contribute to increasing both their economic and their energy efficiency.

Quality Management Systems, by improving the three kinds of economic efficiency mentioned can, if appropriately interrelated to Environmental Management Systems, enhance energy efficiency and reduce the environmental impact of the electricity business.

Quality Management Systems, as the systems of standards they are, lower transaction costs and therefore constitute ideal tools in the framework of functional unbundling of electricity utilities; i.e., what were internal transactions previously taking place within vertically integrated companies will entail higher costs under the new circumstances. From this standpoint they are tools that clearly facilitate the transition to competition.

Quality Management Systems present obvious advantages in reducing the costs of frequent, simple, and safe transactions with low levels of associated investment idiosyncrasy. Since the electricity sector investments with the highest level of idiosyncrasy are Generation-related, Quality Management Systems in that area are applied individually to each generation plant. In Distribution, however, given the lower level of investment idiosyncrasy, it makes sense to apply such systems to the grid as a whole.

Finally, to date at least, Quality Management Systems are voluntary; in our case, they involve an "experience good", i.e., quality is observed ex-post and is, furthermore, only verifiable at a cost to the consumer. If, however, we concede that quality management techniques bolster an electricity utility's performance and diligence, the adoption of a Quality Management System today conveys information to our customers on the quality we will offer tomorrow, thereby ensuring our future relations with them. Furthermore, it is well worth our while to go to the expense of developing quality verification and measurement systems, which is the very same as paving the way to Total Quality.