A QUALITY DECISION MAKING PROCESS : An application for the decision of new products release to the market.

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Summary : *Decision making is a key aspect within organizations, and managers are expected to be more and more proactive and factual in their decisions. The stakes of strategic decisions are crucial to the success of a company. The purpose of this study has been to develop an approach permitting to improve decision making processes. We performed a first application in the context of the decision of a new product launch on the market : the product release. A process analysis has been conducted in order to identify key elements of a decision process and to serve as a basis to conduct a benchmarking survey. We have developed a methodology to conduct a benchmarking and have successfully applied it in order to improve the decision process. Concurrently, decision making theory and tools of aid have been investigated. The product release decision has been analyzed under three orthogonal dimensions that define decision making in terms of its process : the rational, organizational and political dimensions. These dimensions are embedded in a specific context and management system. A decision is a complex situation, which can however be simplified and interpreted as a complicated system that it is possible to model.*
We propose the use of an original application of the Analytic Hierarchy Process, a multi-criteria decision analysis tool. This tool of assistance to the decision-makers permits to have a model for the decision in the form of a hierarchy of weighted criteria. A methodology to implement this tool has been proposed for the specific application of the product release decision.

1 Introduction

1.1 Purpose of the study

The American Productivity & Quality Center (APQC) conducted in 1994/1995 a benchmarking study on the topic of New Product Development (NPD). As a result APQC created a generic NPD process model, based on the combined processes of the best-practice companies *[APQC, 2000]*. We have situated in this process four milestones representing release[1] decisions that enable a successive phase in the NPD process.

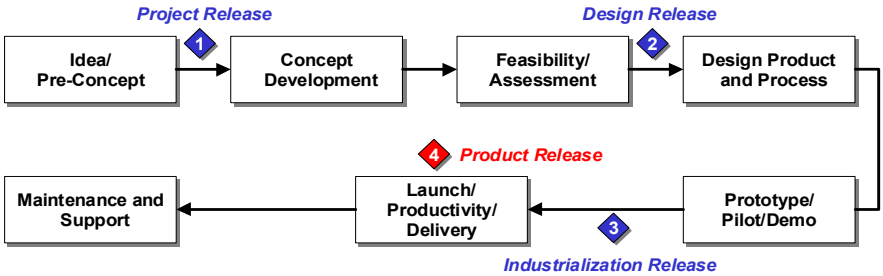

Figure 1.1 : APQC Generic NPD process.

[1] Release : authorization to proceed to the next stage of a process *[ISO/DIS 9000 : 1999)*.

Time to market of new products has to be shorter and shorter and the number of new developments per year continuously increasing. In this context, each phase of NPD process must be efficient and taking good decisions is crucial to the success of a project. The purpose of this study will be to define an approach in order to improve the decision process of a new product launch on the market : the product release *(Figure 1.1)*. We will focus more on the technical aspects of the product and less on the commercial facets (e.g. marketing, communication). The decision-makers require, in particular, information about the product quality (e.g. test laboratories results) and the production process data. Making a bad decision will inevitably lead to losses of profit for the company.

1.2 Decision Making and Quality

For H. Drummond, decision-making is the *raison d'être* of management. She relates a recent study suggesting that managers spend at least fifty per cent of their time dealing with the consequences of bad decision-making *[Drummond, 1999]*. Time which should normally be devoted to innovation and planning is lost dealing with projects behind schedule, looking for failure causes and finding the responsible for the situation. Pro-activity is essential and do the job properly in the first place is cheaper than correcting mistakes. She suggests that an opportunity exists for organizations to create an advantage for themselves by learning to approach decision making with the same rigor and concern for quality as all other aspects of management. The emergence of quality management first, and total quality management later, has led to improvements of the whole organization of the company (quality system). As a consequence of these evolutions, companies have represented their activities as processes that need to be controlled and continuously improved. T. Gidel[2] underlines that this evolution towards process control to reach more performance continues, but concurrently a new approach appears, first considering processes and their added value to define then an operational system responding to it. Hence, the control of the value becomes a central concern and taking effective decisions an absolute need. This principle is consistent with the EFQM and Malcolm Baldrige models, and ISO/DIS 9000 norm.

1.3 Study methodology

The methodology followed has consisted in the first phase in the selection of the decision process (the product release) and its description through a process analysis. This analysis has served as a basis to develop a benchmarking activity. Concurrently, a survey of decision making theory has been made and decision aid tools evaluated. A critical analysis of the findings has led to a decision model built using the Analytic Hierarchy Process (AHP) method. A first application has been made to a concrete problem of product release within the company ETA SA (The Swatch Group Ltd).

2 Process Analysis and Benchmarking Survey

2.1 Process analysis

We have developped a general framework with the intent to represent the product release decision as a process. If the process to build is a sub-process, before starting its construction, it is necessary to situate it in the main process. The application of this framework is a continuous process and therefore it must be regularly applied to the process analyzed. This process building and analysis has permitted to have a formalized view of the product release decision and hence better understand it. Furthermore, this analysis will be a useful basis for the benchmarking survey. Following are the areas where improvement opportunities have been identified :

- Transparency achievement : How is the decision made ?
- Use of a systematic approach : How are data processed in order to come to a decision ?
- The duration of the verification phase : The enabler of the decision process. Is it necessary to wait for the end of this process to start the decision process ?
- Better use of market returns data.

[2] T. Gidel received his PhD. at the Ecole National Supérieure d'Arts et Métiers (ENSAM) in Paris with the thesis "Project risk management by the effective conduct of decision-making process in new products design projects".

2.2 Benchmarking survey

Benchmarking is a widely used tool for performance improvement within organizations that encourages creativity and innovation. What is truly remarkable is that benchmarking has not sooner been embraced as a fundamental business process and skill. Only in the late Eighties and early Nineties has benchmarking become widely regarded as a skill that should be communicated and utilized in day-to-day business operations. Benchmarking has broad applications in problem-solving, planning, goal setting, process improvement, innovation, re- engineering, strategy setting and in various other contexts. Quite simply, benchmarking is a fundamental business skill that supports quality excellence.
We used the model of the U.S. Department of Energy to conduct environmental management benchmarking as a basis to build our own benchmarking model *[U.S. DOE, 1996]*. Basically, the model we developed consists in four main phases : *Planning*, *Data collection*, *Data analysis* and *Action*. It is not the purpose of this paper to explain in depth the methodoly used to conduct the survey. One essential phase of the benchmarking is the analyzis of the gap between the benchmarking parter and the company process. This analysis leads to the suggestion of actions in order to improve the process. Following is an example of a framework to realize this analysis.

Table 2.1 : Benchmarking gap analysis framework.

	Essential element of the company process	***Comparable/ essential element of partner process***	***GAP in Process***	***Action suggested***
Transparency achievement				
Who is responsible of the product release decision and who participates to decision meetings ?	▪ *Responsible :* Quality Management Leader ▪ *Participation :* Testing laboratories leaders, Project Leader, Product Manager.	▪ *Responsible :* Company Management board ▪ *Participation :* Testing laboratories leaders, BU leaders, the customer.	Management board is directly involved in the release decision and the customer participates to the decision meetings.	Evaluate the opportunities appearing by involving the customer in the release decision.
Use of a systematic approach				
What kind of information (data) is necessary to take the decision of the product release ?	▪ *Laboratory testing results* : mechanisms and "housing". ▪ *Consumer Testing* : satisfaction survey. ▪ *Commercial data* : quantities to deliver and delays.	▪ *Laboratory testing results* : mechanisms and "housing" ▪ *Consumer survey* : products analyses and satisfaction survey. ▪ *Production process data* : manufacturing and assembly.	Production data is not evaluated.	Redesign the release decision process in order to introduce the evaluation of production process data.

In the case of the product release decision, we have decided to conduct a *process functional* benchmarking. That is, we have benchmarked the same process (the product release) within other companies who are no direct product competitors. The data analysis realized using the framework previously presented has allowed us to identify actions in order to achieve improvements in the product release process. Benchmarking is a powerful quality tool to improve processes in an efficient and creative way. Approval from the general management is an essential factor in order to conduct an efficient benchmarking survey. The product release process is of strategic importance in a company, it is therefore recommended to carefully choose an apposite type of benchmarking and define clear selection criteria for the benchmarking partners. These different aspects will have to be managed properly according to the company culture and management type.

3 Decision Making

3.1 Decision making process

J. Meijaard in his study of decision making applied to research and development in the Netherlands and USA *[1998, p. 19-21]*, defines *orthogonal dimensions that define decision making in terms of its process*: the rational, organizational and political dimensions. Following are the main elements characterizing these dimensions :

Table 3.1 : *Elements of decision making dimensions.*

Rational	Selective gathering and processing of information, search for alternatives, selection of attractive options.
Organizational	Decision fragmentation, separation and distribution of tasks, handling alternatives.
Political	Bargaining and interactions between key parties, decision-making as a group process.

For a specific decision, the coordinate for each dimension will determine to what extent rational, organizational or political aspects are relevant. We will not extensively develop the different elements beyond the three dimensions, nevertheless, we find interesting to focus on the political dimensions underlying the advantages and disadvantages of group decision making.

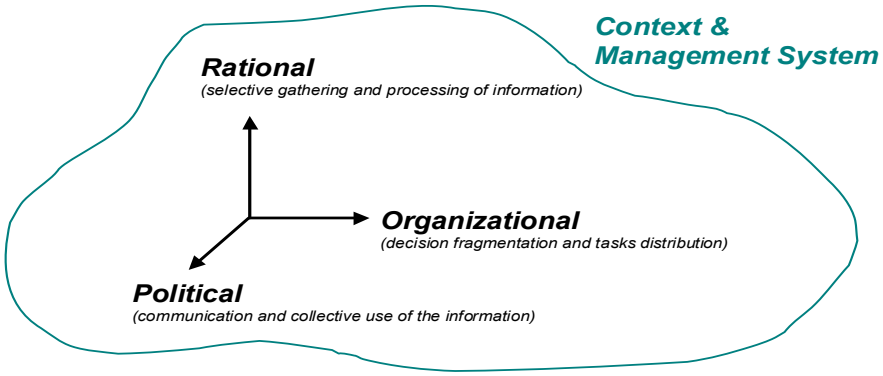

Figure 3.1 : *The three dimensions of decision making.*

J. Meijaard also underlines the importance of the *context* and *the management system*, which determine the effectiveness of the decision process *(Figure 3.1)*. The context, or environment as R. Harris *[1998, p. 1]* calls it, determines the perception of the situation by the parties involved. This perception depends, for example, on the information available, the team members, the preferences and emotional aspects at the time of the decision. This suggests that the context is in constant evolution with a resulting, not insignificant, impact on decision making. It is therefore important, for example, to fit the team composition to circumstances of the decision and determine the "right moment" to make a decision.
The management system includes the local *structure* and *culture* that influence the decision. The structure refers essentially to the hierarchical organization of the company. Karim Hamed and Pascal Miconnet[3] *[1999, p. 10]* underline the importance of culture influence on decision making by confronting northern American with Japanese approaches to decision : *doing vs. being* cultures. Doing cultures, will put value on active and decisive behaviour. "Making things happen" is a way of life, while taking time for reflection (being orientation) is generally considered as ineffective management. In contrast, a being culture, like Japan, considers quick decision-making as impulsive behaviour, consequence of a lack of maturity.

3.2 Theories classification

We think that T. Gidel's classification *[1998, p. 74]* of decision theories into analytic and systemic ones synthesizes well the different approaches to decision making. The following table summarizes the main characteristics and postulates that he found :

[3] K. Hammed and P. Miconnet have won the EFQM Award 1999 for best European master's thesis in Total Quality Management.

Table 3.2 : *Two approaches to decision making [Gidel, 1999].*

Analytic theories	Systemic theories
Programmed decisions, structured, routine	Non-programmed decisions, non structured, problem solving
Rational thinking, disjunctive, algorithmic	Heuristic thinking, conjunctive
Search of an optimum, of efficiency	Search of the "satisficing", of effectiveness
Complicated situations	Complex situations
Substantial or classical rationality	Procedural, limited or multiple rationality

3.3 The decision process of product release

In the previous sections, we have described how to define a decision in terms of a process with three orthogonal dimensions (i.e. rational, organizational and political) and two different approaches to decision making (i.e. analytic and systemic). Let's first analyze with the aid of the table 3.1, the product release process in order to situate to what extent each dimension is relevant and to identify improvement opportunities. This will be done on the basis of our ground experience of the product release. Whether the release decision will have to be considered following an analytic or a systemic approach will be also discussed.

Rational dimension

Basically, it is a question of evaluating what information is necessary to decide, in what form it is (reports, database, ...) and how it is processed in order to come to the choice of one alternative. Information to start the decision process concerns the product and it associated process. This information is generally both quantitative (e.g. percentages) and qualitative (e.g. good/average/poor) and is evaluated by a team, usually experts. The processing of the information can be executed randomly starting for example from aspects appearing more relevant to the team. The alternatives of the decision are only two : "product released" or "product not released". In case of a non release different scenarios are possible (e.g. modification of the product shape or assembly process, ...).

Organizational dimension

The question is to what extent can the decision be fragmented (sub-decisions) and how can this be controlled and coordinated. When a decision is taken at the extreme end there could be an excess of information to process with associated risks.

Political dimension

Basically, here it is a question of evaluating if group decision making is appropriate to the product release process.

The personality (e.g. the charisma) or hierarchical position of people involved in the decision can steer the discussion towards a specific direction. Another aspect that we experienced is a lack of transparency towards the interested parties if they are not involved in the decision process.

Context and management system

The *context* relates to the perception of the situation by the decision-makers at the time of the decision. This suggests a definition of the "best" moment to start the decision process (e.g. according to the information available) and the choice of an appropriate team. The *management system* concerns basically the structure and culture within the organization. It is a non-negligible aspect having an influence on the decision process and would require extensive research, which is beyond our study. The following table summarizes the findings of our analysis.

Analytic vs. systemic approach

Independently from the analysis of the product release process according to the three dimensions, we would try to position the product release decision in relation to analytic or systemic approaches *(Table 3.2)*. For us the product release can be seen as a *programmed* decision process because it is a clearly defined milestone in the new products development process, even if for example the product to release

and the decision team change at each release. The alternatives, as discussed before, are limited : "product released" or "product not released", but for a given decision the consequences are not necessarily the same. Decision-makers perceive the situation according to their own subjective view and furthermore they do not have a complete mastery of all the consequences of their choice. Using Simon's expression, we can say that the release decision is a *satisficing* one, because of the complexity of decision making in an organization and the impossibility to make an exhaustive search to find an optimum. We are clearly facing a complex[4] situation where interrelated elements are present, and for example decision-makers interactions cannot be described rationally. Nevertheless, many elements of the decision can be considered "only" very complicated to be described and understood (e.g. qualitative decision criteria).

Table 3.3 : *Findings concerning the product release decision.*

1.	Need to structure and select the relevant information in different, clearly defined, categories.
2.	Need to use a systematic approach in the processing of the information permitting the evaluation of both qualitative and quantitative data.
3.	There is a limited number of alternatives "product released" or "product not released"
4.	Need of a decision model defining clear sub-decisions with relative responsible persons.
5.	Potential improvement by realizing group oriented decision.
6.	Definition of the "best" moment to start the decision process (e.g. according to the information available) and choose an appropriate team.

3.4 Summary

In this chapter we have analyzed the product release considering three orthogonal dimensions defining decision processes (i.e. rational, organizational and political). These dimensions are embedded in a specific context and management system. The findings of this analysis are presented in the table 3.3 and will be a useful input to improve the decision process. The analysis of analytic and systemic theories on decision making has highlighted the fact that the release decision can be defined as a complex situation with several complicated aspects.
We will approach the release decision as an analytic process. This can be seen as a simplification of the whole problem and be the starting hypothesis to model this decision. Without "robotizing" the decision and still leaving an important place to the decision-maker experience, a rational approach will highlight essential elements of this process. The Analytic Hierarchy Process discussed in the next chapter is a decision making tool that will help us to improve the product release decision process.

4 The Analytic Hierarchy Process (AHP)

4.1 The AHP Method

The Analytic Hierarchy Process (AHP) is a decision making tool for multi-criteria decision analysis. AHP mathematical theory has been developed by T. Saaty[5] in the 1970's, while he was teaching at the Wharton School of the University of Pennsylvania. Dr. Saaty has worked for the U.S. State Department and has consulted on the AHP and decision making with dozens of corporations and agencies.
AHP is a method of breaking down a complex, unstructured situation into its component parts; arranging these parts, or variables, into hierarchic order ; assigning numerical values to subjective judgements on the relative importance of each variable ; and synthesizing the judgements to determine which variables have the highest priority and should be acted upon to influence the outcome of the situation *[Saaty,*

[4] We distinguish a "complex" from a "complicated" situation. In a complex system everything depends on everything else, there is the idea that the whole is not the sum of the parts and a large number of interactions is present. A complicated system can be subdivided in its parts and is just difficult to be analyzed ; an optimal solution can be found.

[5] Dr. Thomas L. Saaty earned his Ph.D. in mathematics at Yale University and did post-doctoral work at the University of Paris. He currently holds the chair of University Professor at the University of Pittsburgh.

1995]. The first step of AHP is to model the decision by defining a hierarchy of criteria grouped in different clusters. For each cluster, pairwise comparisons will permit to derive priorities that reflect the perception of the problem (e.g. criterion A is three times more important than criterion B and four times more important that criterion C, etc.). The judgment we apply in making paired comparisons combine logical thinking with feeling developed from informed experience *[Saaty, 1995]*. Then, the method will compute, on the basis of these pairwise comparisons, the relative importance (weight) of each criterion[6]. The next step is to assess the consistency of judgment made in pairwise comparison. That is, if you say that criterion A is three times more important than criterion B, and criterion B four times more important that criterion C, criterion A must be twelve times more important than criterion C. Saaty developed a mathematical approach, based on matrix algebra, to measure a consistency ratio. The *consistency ratio* of the hierarchy should be 10 percent or less. If it is not, the quality of information should be improved, perhaps by revising the manner in which questions are posed to make the pairwise comparisons *[Saaty, p.95]*. At this point, the hierarchy created allows rating each alternative with respect to each criterion (or sub-criterion if present) on a scale of nine units. The alternative with the best score will reflect the preference of the decision-maker.
We have voluntary decided, in the context of this thesis, not to develop the mathematical aspects of the method and to focus on its implementation. On the market there are several software products implementing AHP with user-friendly interfaces. We choose the software Expert Choice© 2000, to whose development gained benefit from T. Saaty experience.

4.2 AHP applied to product release

We propose in this section an original application of AHP applied to the specific situation of the product release decision.

Phase 1 : *Define the decision*
Define the problem and specify the solution desired. Brainstorm the decision criteria.

Phase 2 : *Structure the decision model*
Building a hierarchy is as much an art as it is a science. Following are guidelines that you need to keep in mind before beginning to build any model *(from Expert Choice© Tutorials).*
Guideline 1 : Try not to include more than nine elements in any cluster because experiments have shown that it is cognitively challenging for human beings to deal with more than nine factors at one time and this can result in less accurate priorities.

Guideline 2 : Try to cluster elements so that they include elements that are "comparable", or do not differ by orders of magnitude. In other words, try not to include items of very small significance in the same cluster as items of greater significance. The purpose of a hierarchy is to cluster the more important elements with each other and the less important elements with each other.

Phase 3 : *Set priorities*
Structure the decision as a hierarchical model. Make pairwise comparisons of the criteria and sub-criteria for their importance in the decision. If the results of your decision model differ from your intuition ; you can modify the model and/or judgments until the model incorporates your intuition. Then the model results will change to conform to your "gut" feeling.

Phase 4 : *Verify the consistency*
The inconsistency measure is useful for identifying possible errors in judgments in making pairwise comparison. In general, the consistency ratio should be less than 0.1 or so to be considered reasonably consistent.

Phase 5 : *Calibrate the system*
Three zones must be defined between 0.1 and 0.9 representing the two "product released" and "product not released" zones and another zone in the middle representing a "conditional release". This last release leads for example to a limitation in the quantity of pieces to produce and the final decision is delayed. In order to define decision thresholds, we propose the realization of a calibration using past representative release decisions. These thresholds have to be continuously reviewed and adapted using market returns data.

[6] Mathematically this is made by computing the eigen problem associated with the matrix resulting from the pairwise comparisons.

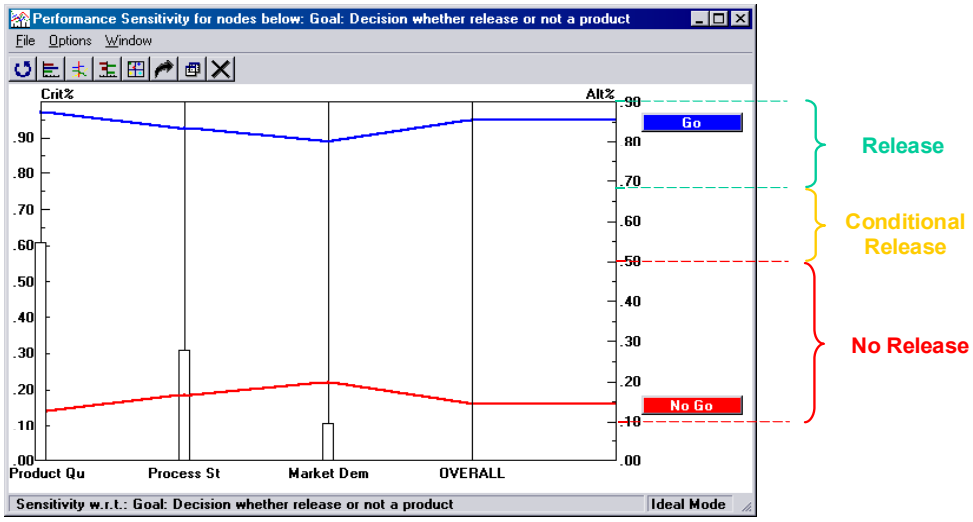

Figure 4.2 : *Product release decision thresholds (Expert Choice© application).*

Once the system is built we have the complete decision model and it can be used to make the release of a specific product. This is done by comparing the alternatives (Go / No Go) for their preference with respect to each criteria and sub-criteria. A sensitivity graph gives a view of the result *(Figure 4.2)*. Depending in which zone the result is situated, the decision will be a *release*, a *conditional release* or a *no release*. Following is an example of criteria hierarchy built using the methodology presented above. The general criteria identified in our study (principal criteria) are the *market demand*, the *product quality* and the *production process*. The weight attributed to each criterion will vary from a company to another.

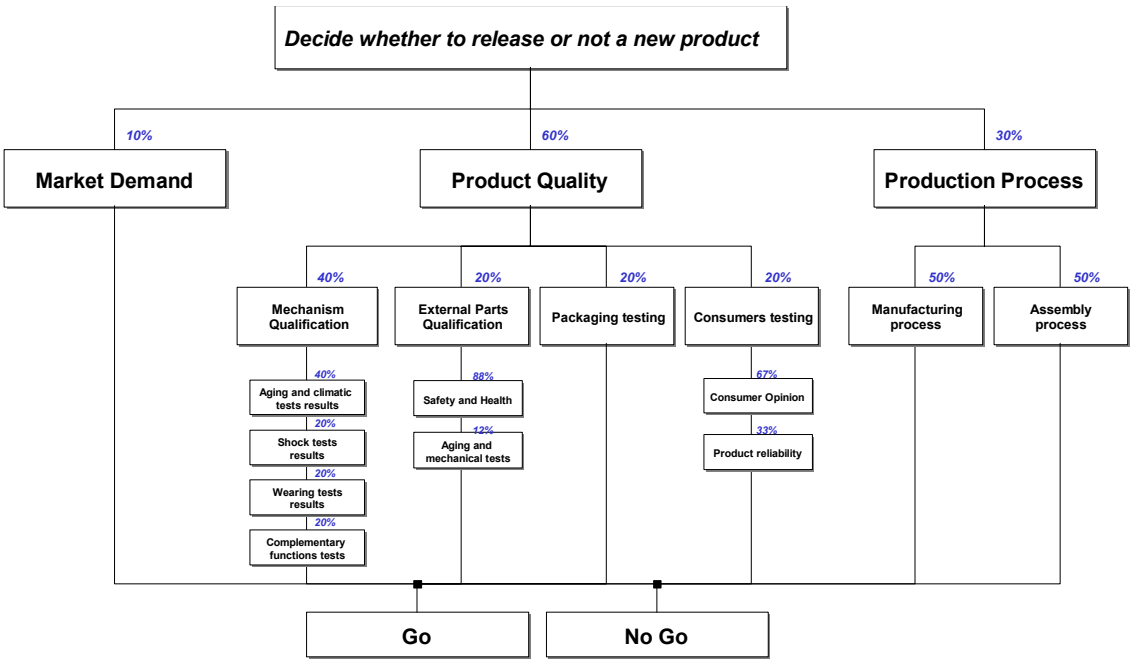

Figure 4.3 : *Example of criteria hierarchy for product release.*

4.3 General considerations on AHP

One of the critical points of AHP is the pairwise comparison approach. For example, if you say that criterion A more important than B, does this mean 2 times, 2.3 times or 4.1 times more important ? That is why we use pairwise comparisons just in order to define a first hierarchy, then adjusted with the involved parties feeling and experience. It is not all the time possible to evaluate each sub-criterion (e.g. information missing). In this case, the method remains valid and the result (decision) is computed without considering the missing criterion. Furthermore, the decision model (criteria hierarchy) can anytime easily be completed and refined by adding criteria or sub-criteria. In general, we noticed a confidence from people within the company for this analytical method and no fear to use it. We had good results in the application of this tool.

4.4 Summary

We have presented in this chapter a multi-criteria decision analysis tool : the Analytic Hierarchy Process (AHP). A methodology to implement this tool has been proposed for the specific application of the product release decision and an example of criteria hierarchy has been given. It should be noticed that the AHP is a tool of assistance to the product release process, which is not replacing the decision process. It could be viewed as one of the activities in the whole process. As already expressed, such approach is a simplification of the complex situation defining a decision process within organizations.
To what extent does the AHP method improve the product release decision process ? The following table gives some relevant points according to the findings presented in section 3.

Table 4.1 : *Product release decision aspects and AHP Method.*

	AHP Method
1. Need to structure and select the relevant information in different, clearly defined, categories.	*Made by building the criteria hierarchy (decision model).*
2. Need to use a systematic approach in the processing of the information permitting the evaluation of both qualitative and quantitative data.	*Each criteria and sub-criteria is systematically evaluated in order to make a decision. Both qualitative or quantitative criteria can be expressed on a nine points scale.*
3. There is a limited number of alternatives "product released" or "product not released"	*Alternatives are part of the decision model. Using decision thresholds, we can add an intermediary decision :* "*conditional release*".
4. Need of a decision model defining clear sub-decisions with relative responsible persons.	*The decision model is defined by the criteria hierarchy. For each criteria or sub-criteria a responsible person can be identified.*
5. Potential improvement by realizing group oriented decision.	*Is possible with Expert Choice© with group capability. This option should be evaluated in a further study.*
6. Definition of the "best" moment to start the decision process (e.g. according to the information available) and choose an appropriate team.	*Each sub-criterion can be evaluated as soon as the information is available.*

5 Conclusion

Decision making is a central concern in management systems as underlined in the fundamental concepts of EFQM, Malcolm Baldrige and ISO/DIS 9000. Proactivity, effectiveness and factual approaches are crucial for the success and performance of a company. In this study we have developed an approach permitting the improvement of decision making processes. We have implemented the approach in order to verify its applicability in the case of the decision for new products release. We have first performed a

process analysis to identify improvement opportunities and serve as a basis for a benchmarking survey. This has permitted to integrate creative solutions to the decision process. Concurrently, decision making theory has been investigated and decision aid tools evaluated. As a result we propose an original methodology to implement a multi-criteria decision analysis tool : the Analytic Hierarchy Process (AHP). For further research on the topic of decision making processes improvement, we propose the following directions :

- Additional applications of the Analytic Hierarchy Process tool within other companies and search of general representative decision criteria.
- Application of the approach for other decision processes (e.g. design release).
- Integration of a group decision approach for the evaluation of each decision criteria.

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