Flexibility in Multicriteria Competitive Intelligence for Operations Management

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Abstract

The objective is to apply an evaluation and optimization model of flexibility in competitive intelligence for operations management in organizations employing the association of multivariate analysis (factor analysis) with multicriteria methods. Among the several multicriteria methods was opted for VIP (Variable Interdependent Parameters). An important conclusion of this work is that one can not only analyze but also optimize the flexibility of competitive intelligence through the application of multi-criteria methods. This allows an evolution in the learning process of competitive intelligence for operations management.

Key-words: Competitive intelligence; operations management; flexibility.

1 INTRODUCTION

The creation of new ways of competitive advantage became one of the largest challenges for the decision maker in turbulent environments that change quickly and unpredictably, especially in the operations management process.

The competitive advantage of an organization is usually contemplated in its superiority in the elaboration of its basic competence with the purpose of evaluating and optimizing its competitive intelligence.

The objective is to apply an evaluation and optimization model of flexibility in competitive intelligence for operations management employing the association of multivariate analysis (factor analysis) with multicriteria methods.

Among the several multicriteria methods was opted for VIP (Variable Interdependent Parameters) because this method evaluates each action according to its intrinsic absolute merit (Dias, L. C. & Climaco, J. N.; 2000, p. 3). Multicriteria methods allows the examining of the intrinsic value of each action with robustness according to definition of Roy (1992), in order to propose an appropriate recommendation for each one of them and to optimize the decision process.

2 LITERATURE REVIEW

2.1 Competitive intelligence

Competitive intelligence is to notice a process of transformation of information disaggregated regarding the competitors effective or potential, in operations knowledge important and usable for the organization (Sutton, 1988). For Choo (1998), following a more synthetic form and aiming to understand the competitive intelligence, with quite specific focus, the definition limits to the monitoring of actions. Johnson (1995) corroborates when notices that competitive intelligence is the competitors' deliberate and coordinated monitoring, as form of knowing what the competitors will properly do before the action is executed. In the definition...
of Fuld (1996), the competitive intelligence is portrayed as being the information analyzed on the competitors that has implication in the decision making of the organization. Hohhof (1994) increases the systemic vision process when referring to the competitive intelligence as the systematic collection of information, its processing, analysis and distribution to the responsible for the decision making.

In a wider way, Kahaner (1996) and Jakobiak (1997) notice the competitive intelligence as an institutional and wider systematic process, integral of the operations administration of the organization and responsible for the supply of information and knowledge generation for the decision making, seeking the attainment of the organizational objectives. The emphasis in the external environment, and not only in the competitors, it is pointed out by Herring (1997) and Tyson (1998) when they define competitive intelligence as a organizational process collection and systematic analysis of information on the external environment.

Understood in a more restricted or wider way the referenced authors, the concepts present convergent and crucial aspects for the understanding and conceptual definition of competitive intelligence. Those aspects can be described as:

- The competitive intelligence can be understood as a process, a continuous cycle of activities that allow the planning, the collection, the analysis and the dissemination of information;
- That process is constituted by a systemic and planned group of activities that allow the learning and the development of knowledge in relation to the environment in that the organization is inserted;
- The knowledge generated by the competitive intelligence process helps in the operations management, on the part of managers, in search of the organizational objectives.

In that way, it can be inferred that competitive intelligence is a systematic process of collection, treatment, analysis and dissemination of information on activity of the competitors, technologies and general tendencies of the businesses, seeking to subsidize the decision making to reach the strategic goals of the organization. Associated to the intelligence concept, understood as a process, allows an integrated vision of activities or much defined stages seeking to obtain information, to analyze the possible resulting implications and to inform to the interested ones regarding the threats or current opportunities of the competitive environment.

Kahaner (1996) understands competitive intelligence - CI, as a systemic process that has for purpose to provide benefits for the organization for the supply of information that subsidize the decision making, points out although that process is cyclical and dynamic, starting from the needs of information and knowledge of the organization, tends to the basic strategic planning. The cycle described by Kahaner (1996) comes as described in the Figure 1.

The strategic management of the cycle of competitive Intelligence ponders all the efforts to administer the planning stages, collection, analysis and dissemination of information and knowledge regarding the competitive environment, integrated by the competitors, new technologies and for the general businesses environment.

Each stage develops own activities and possesses clearly defined functions and integrated, could be characterized as sub processes or activity of the process of competitive intelligence. The first stage is the planning. In the aspects that concern the efficiency of the operations management of the process, the planning is the most important phase, because in it are defined: the mission, the objectives, the strategies, the action plans and the resources (materials, humans and technological) necessary to reach success in the processes.
The planning of competitive intelligence includes all the stages of the process. The planning of the collection seeks to identify, starting from the type of information to be used, the sources, the suppliers and the means for which the information will be captured.

![Figure 1 - Cycle of Competitive Intelligence](source: adapted from Kahaner (1996))

In the planning of the analysis process, they will be suitable the needs of resources material, technological and humans for the processing of the collected information, as well as the suitable methodologies for the analysis process, in agreement with the type of collected information.

The dissemination plans will owe dimension the necessary resources, in agreement with the mission and objectives, for the communication activity between analysts and decision makers, seeking to make available information and knowledge.

The relationship between the planning activity and the other activities of the process of competitive intelligence, seeks to establish in a clear way the direction that the operations management of the process should proceed. However, it should also gain to the process enough flexibility to travel directions alternative face to the turbulences of the environment that surrounds the organization.

The collection of data and information are the phase of the cycle of competitive intelligence that has for objective to apprehend the elements strictly necessary for the analysis of information and development of knowledge regarding the competitive environment. To look strictly at the collection of the elements necessary, besides bringing objectivity to the analysis phase, it avoids the accumulation of undesirable and useless information.

Several known techniques exist to accomplish the collection of information originating from the forms of approaches of the sources of information. The conventional forms of obtaining information can be presented in agreement with the nature of readiness in physical collection, mechanic or automated collection and computerized collection. If the information have origin in printed publications, the physical collection is indicated. Could be made by the internal or external agents to the organization, as it is the case of the companies of clipping services. When the information refers to a process that involves count or any measuring of physical greatness, the automated collection should be used, accomplished through appropriate instruments. In treating information of digital nature, making available in magnetic medium, databases and internet, the procedure of computerized collection is the most probable.

The analysis is the stage of the cycle of competitive intelligence characterized by the intervention of human being intellectual abilities in the processing of the information. As described by Kahaner (1996), analysis is the process of transforming the information in knowledge for use of the intelligence.

After the collection stage, the information is made available for the analysis in physical files (libraries, collections, etc.) and logical (database, texts, sounds and images) and object of processes and techniques that stimulate the elaboration of prognostics regarding the competitive environment.
With base in those aspects, the organizations disseminate the information in three ways: active, passive or mixed. The active dissemination gathers resources and means to take the information to the decision maker, could use intranet resources, extranet, electronic mail, and distribution of printed reports or presentations. The passive form presents as main characteristic the access availability of information for the decision maker, usually in electronic or physical libraries, with access and safety levels previously determinated. The mixed form contains dissemination characteristics of both active and passive dissemination. This mixed form allows establishing a larger entail of relationship between the administration of the competitive intelligence and the decision makers.

2.2 Flexibility in Competitive Intelligence
The influence reciprocity between organizations and environment can be understood through Thompson's perception (1967) that establishes the systemic vision of those relationships. In the same way that the organizations need inputs from the environment to elaborate products and services, those come back to the environment as necessary elements for the satisfaction of the social demands.

The organizations, conscious of the proportionate dynamics for the interactions with the social environment, try to establish forms of performance more and more gone back to the search by the answer capacity and for the adaptation in relation to the impositions and flotation in the environmental context in that interfere.

For Kotler (1998, p. 71-72), the adaptation of the organizational actions to the situations mutants of its markets and environment, happens through a managerial process that seeks to maintain a viable adjustment among the objectives, experiences and resources - the organizational strategic planning. The measure in that the variations caused by uncertainties, turbulences, competitiveness and the whole range of own changes of the environmental dynamics become more and more present in the organizational context, larger becomes the effort to be accomplished for the search of information that subsidized the operations decision in the organizations.

Therefore, the strategic process needs to establish forms of constant and dynamic monitoring in relation to the environment, in the sense of to obtain information and to develop knowledge that promote the survival and organizational evolution in the context in which interferes. The competitive intelligence comes in that context as a process that looks for, in its essence, to provide larger competitiveness, survival capacity and evolution to the organization face to the environmental prognostics generated by the transformation of information in knowledge.

In way to narrow the relationship between strategy and competitive intelligence, Kahaner (1996, p. 23-35) appears as a process accessory to the first, where information and knowledge look for to advance changes of the competitive environment; to learn on technologies, products and processes that affect business; to learn on changes political, legislative or regulatory; to learn on new incoming; to help in the implementation of managerial tools and to notice the business with the open mind for new practices. The same author still refers the competitive intelligence as a process that presents wide advantages for the operations decision (Kahaner, 1996, p. 39).

In summary, the proposition of the process of competitive intelligence in the organizations, composed by the planning, collection, analysis and dissemination of information subprocesses, are to subsidize the strategic decisions making in face of the influences and environmental interdependences, seeking to the survival and the organizational evolution.

The process of competitive intelligence needs flexibility in planning, collection, analysis and dissemination of information. Besides, the organizational model proposed to institute the
The process of competitive intelligence should possess characteristics that make possible flexibility in terms of referring aspects of control, formalization, change, learning, partnerships, and technologies.

The organizational flexibility can be approached, according to Volberda (1998), under the aspects of organizational preservation or change. The concept of flexibility can be understood as preserving the organization, considering structure, processes and culture, or promote alterations in those form elements to provoke significant changes in relation to the situations and environmental variations.

The approach of Upton (1995), relates the concept of flexibility to the capacity of the organization in implementing changes or to adapt to a certain context, looking for the effectiveness of its actions, close to the environment, through the maximization of its adaptation capacity when reacting to the variations and environmental uncertainties. With base in those references is noticed the organizational flexibility as a process of significant changes in relation to structures, processes and culture, as form of adapting to the environmental dynamics.

Added those aspects, Bahrami (1992) indicates that a rigidity degree or flexibility settles down as the organization looks for the balance between centralization dimensions and decentralization, stability and dynamism, uniformity and diversity to reach the wanted levels of effectiveness.

When establishing the bases of the study of the flexibility in the process of competitive intelligence, Ramos (2004, p. 76-79), presents model based on the verification of indicators related to each sub-process of CI understanding: the diversity of resources, the innovation degree verified, the tendency to changes increases the velocity of implementation of changes, the tendency to the learning of simple cycle or double cycle, the tendency formalization or no formalization, the indication of controls more rigid or less rigid and the participation intensity.

That approach allows to notice in each sub-process of competitive intelligence, intensity of presence of each indicator, as element characterization of the flexibility in the process.

For effect of modeling of that study they are taken as criteria, the flexibility in the sub-processes of established CI for Kahaner (1996) and as alternatives the indicators referenced by Ramos (2004) for study of the flexibility in the process, such as:

- **Diversity** - variety of objects in each sub-process, and in the planning comes in relation to the objectives, in the collection with relationship to the sources, in the analysis with relationship to the diversity of available techniques and in the dissemination in relation to the means used for the dissemination. It is noticed that as greater goes the diversity of objects in each sub-process, greater will be the flexibility presented by the planning;
- **Innovation** - the innovation degree tends to provide larger flexibility to the sub-processes when comes in larger intensity;
- **Change** - it can occur in incremental changes or radical changes;
- **Velocity** - it is the degree of speed as changes are implemented. It suggests larger flexibility when the verified changes happen with larger implementation velocity;
- **Learning** - it can present tendencies to the development in simple cycle and double cycle. As the tendency to the development in double cycle, it will be the tendency the flexibility of the process;
- **No formalization** – the greater is the tendency to no formalization of the process, greater will be the tendency to flexibility;
- **Control** - it can present tendencies to the establishment of rigid controls or slack controls. The greater is the tendency to slack control greater will be the flexibility in the process;
Participation - tells respect the collaborators' participation in the process. The greater is the degree of collaborators' participation in the process greater will be the degree of flexibility verified.

2.3 Multicriteria Methods
Most of the works was developed by Roy (1973), which proposed one of the multicriteria theories for resolution of decision problems.
Multicriteria System – is defined as the use of an aggregated model that contemplates multiple objectives, in general decisions.
The concept of Goicoechea et al. (1982), also, determines the need to identify and to consider many objectives simultaneously in analyzes and solutions of the problems, what will allow a better organization of information and of each participant's role in the several stages. It allows evidencing the conflicts among the objectives, quantifying the degree of existent commitment among them and treating each objective in the unit of more appropriate measuring, without the distortions introduced by the simple conversion into monetary units, for instance.
The idea is that, when confronted with the need of developing a model of some complex system, begin with the basic model, while is tried to build an aggregated model. This can be implemented, among other tactics, through the multicriteria methods, defined here as a group of actions.
Starting with a finite group of potential feasible actions $A = (a_i; \ i = 1, \ldots, m)$, that can be considered as a “consistent family of criteria.”
Each one of these criteria, supposedly and perfectly identical but not necessarily and completely known in all its qualities and amounts.
The evaluation are multiple and often structured in multi-level hierarchies, with quantitative and qualitative assessments being coexistent. It is evident that a multicriteria model analysis with the capability of handling both quantitative and qualitative data is desirable for making the evaluation effective and consistent. In this paper we present a VIP analysis, Dias, L. C. & Climaco, J. N. (2000) approach to deal with flexibility problem. We conduct an empirical study to demonstrate how the model can be used to support dispatching decisions under various degrees of situations.

3 METHODOLOGY
The investigation intends to present and to apply an evaluation and optimization of flexibility model of the competitive intelligence in organizations using methods of support multicriteria to the decision. Among the several multicriteria methods analyzed was opted for VIP (Variable Interdependent Parameters) that is an instrument of help the decision making conceived to treat problems that consists of examining the intrinsic value of each action, in order to propose an appropriate recommendation for each one of them and to optimize the decision process.
Factor analyzes were performed on the set of data to obtain the factors expressing the several components of the flexibility, namely, flexibility in planning; flexibility in collection of data; flexibility in analysis; and flexibility in dissemination of information. With base in the technique of extraction of the main components an only factor was defined to be extracted of the group of collected data, obtaining this way, the factorial loads standardized referring to the 81 specialists' perceptions with entail professionals in public and private companies associated to ABRAIC–Brazilian Association of the Analysts of Competitive Intelligence on the variables that influence the flexibility of the process in competitive intelligence.
The research was accomplished during the encounters of ABRAIC where a questionnaire was applied structured on the process seeking to verify the characteristics of flexibility. The public organizations as the private, frequently face problems of decision making whose objective is to reach several imperatives imposed by the market, because it is difficult that a decision can satisfy several actors that has direct relationship with the solution of the problem, the stakeholders. Or in another way when the criteria are adopted they are more numerous so that one can choose which of those they would be adapted to the solution of the problem. The analysis multi-criteria takes into account the realism and the legitimacy of the important parameters for the organizations, in one moment in that the complexity of the decisions is recognized by most of the involved actors, or when at least not all are shown with the same sensibility before the proposed criteria.

The multicriteria method is, therefore, a tool that allows to the decision maker the resolution of a problem in which there is to take in consideration several points of views (criteria) that are frequently contradictory or excluding, therefore the method doesn't have for objective to point the best solution, but to optimize what best answer to the proposed model, that provides a coherence among the evolution of the process.

The decision makers in the context of performance have need to evaluate actions (alternatives) defined before the outrage existence, uncertainty, imprecision or contradictions concerning the values of the parameters. The method of support multicriteria allows to the same ones to use evaluation models, which the parameters can be better optimized. In other words, being used of imprecise information, in which the decision makers can indicate multiple acceptable combinations of values for the parameters. Using imprecise information based on robust conclusions, valid for all the combinations of values for the parameters accepted by the decision makers.

Therefore, the use of support multicriteria to the decision, involves a focus multidimensional, incorporating a series of much defined characteristics in relation to the methodology, in other words, to identify information and critical points; a better understanding concerning the problem; the possibility there to be different formulations, previously not shimmered; complexity and not always most of the time expressed numerically.

The analysis of the alternatives that influence the flexibility in competitive intelligence was made using multicriteria methods. The employed method in that work used the software VIP–Variable Interdependent Parameters.

The software VIP seeks to support the selection of alternatives, among a suitable list for specialists, verifying the ones that assist the patterns of expected acting in the multicriteria evaluation. The program bases on the model of addictive aggregation is (function of addictive value), accepting imprecise information concerning the importance of each criterion. That contemplates in the values of the parameters of the model designated by scale coefficient (or constant of scale), although of direct form and in dissociable of the functions of partial value (mono-criterion).

Imprecise information is translated by a group of restrictions which the scale values should obey, what corresponds to consider multiple acceptable combinations for those values. To work with imprecise information assumes matter relevance, because in spite of the simplicity of the function of addictive value, use becomes difficult for who has to supply the values for those parameters.

In fact these parameters represent the preferences of the decision makers that can be difficult to quantify in a necessary way. The arbitration of the options as well as the consent absence in decisions of groups, they usually hinder the demands of necessary values for the scale coefficients (Almeida et al., 2003).
The program calculates the interval of global value of each alternative and the matrix of extreme confrontation (to the pairs), the one that allows identify them dominated or quasi-dominated, besides the maximum regret associated to each choice of alternatives and the domain where each alternative is optimum or quasi-optimum.

The software and the methodology were developed by Luís Dias and João Climaco (2000). The use of that software seeks to give support to the decision making in choice problems where the decision maker wants to select an alternative of a group of potential alternatives simultaneously in agreement with the multiple criteria.

The employed criteria in the analysis of the flexibility in competitive intelligence were: Flexibility in Planning; Collection; Analysis and Dissemination.

The analyzed alternatives were: Diversity; Innovation; Change; Velocity; Learning; No formalization; Control and Participation.

4 ANALYSIS

Based on the specialists' evaluation it was stipulated that the criteria should initially have the following weights: Flexibility in Planning = 0.30; Flexibility in Collection = 0.15; Flexibility in Analysis = 0.25; Flexibility in Dissemination = 0.10.

In the Figure 2 it is observed that the values calculated by VIP for the alternatives they were the following ones: Diversity = 0.621; Innovation = 0.752; Change = 0.752; Velocity = 0.744; Learning = 0.771; No formalization = 0.757; Control = 0.75; Participation = 0.731.

This indicates that the alternative Learning has the largest value (0.962 for minimum value and 0.966 for maximum value) and, therefore the most important among those alternatives.

The output indicates that the alternatives Diversity, Innovation, Change, Velocity and Participation are dominated absolutely because their maximum value is smaller than the minimum value of Learning and No formalization. Therefore, any that are the constants k1, …, k4 the listed alternatives above are considered worse than the last two mentioned.

In the Figure 3 the absolute variation can be verified among the alternatives where the alternative Learning has dominance relationship represented graphically on the other alternatives and No formalization in second place.
In the Figure 4 the graphic variation for order analyzed by the minimum value corroborates that the best choice is the alternative Learning followed by No formalization using the superior and inferior limits shown on the left side of the Figure.

In the Figure 5 is observed the maximum regret graphically. In that Figure the possibility of the group of alternatives is filtered by maximum regret where the decision maker will be able to focus the alternatives that are always superior to the point of cut 0.7.
5 OPTIMIZATION

The Figure 6 displays the domain of the optimality of the selection of the better two alternatives. Graphically it is observed that is the best among the pointed ones for the decision makers.

Best: V(Learning) = 0.961
Figure 6 – Optimality Domain between Learning and No formalization.

It can be noticed through the triangles that the domains are not very different in size. The combination of constant scale of values that appear in the last line of the Figure 6 display the values (k1 = 0.196; k2 = 0.445; k3 = 0.259; k4 = 0.1); V (Learning) =0.961; V (No formalization) =0.941; Better: V (Learning) =0.961. This corresponds to the points selected in the green area of the triangle. The reverse happens in the dark blue area.

In the Figure 7 the software allowed the comparison between the alternatives Learning and Innovation taking into account all the criteria.

Best: V (Learning) = 0.963
Figure 7 – Optimality Domain between Learning and Innovation.
6 CONCLUSIONS

An important conclusion of this work is that we can analyze and optimize the flexibility of competitive intelligence for operations management through the application of multicriteria methods. The approach of competitive intelligence is relatively recent and its analysis of the point of view of the flexibility presented here is new and robust. The employment of factor loads to serve as making explicit of the acting of the alternatives in relation to the criteria is also new and quite robust.

It was verified that the application of the technique of factor analysis, with the purpose of containing the variables in study, based on interdependence relationships, with the application of analysis of main components for the formulation of representative only indicator of the interviewees' perceptions with relationship to the intensity of the participation of each alternatives in the composition of each criterion, provided success in the search for that representation.

Starting from that representation for the alternatives, the criteria were considered in agreement with the specialists' opinion that they attributed the importance of each criterion in agreement with its influence in the process of competitive intelligence. That verification established the basic matrix for the application of the multicriteria techniques, as indicated the Figure 2, making possible the associated use of the two techniques.

That methodology possesses innovative character, in association terms between quantitative techniques and multicriteria, once it makes possible before to enlarge the focus in the analysis regarding study objects just submitted to inferences based on parametric theories or simply linked to associative techniques. The integration and interaction here unmasked point to use as powerful tool for the decision making.

In the analysis of the flexibility in the process of competitive intelligence for operations management, tends as base the criteria of flexibility in each planning, collection, analysis and dissemination of information sub-process starting from the established alternatives as indicators of that property, the dominance of alternatives is verified for the decision making, gone back to the learning establishment, seeking to transform the process.

The dominated relationships or quasi-dominated if they present as secondary alternatives, influenced by the dominancy of the Learning. That means that when establishing priorities with relationship to Learning, besides increasing the potential or optimizing the other alternatives is obtained a maximum regret degree in relation to that priority. In other words, when investing in Learning the return in terms of flexibility of the process has smaller possibility to cause difficulties to the investment.

7 REFERENCES


