Modern Management Science & Engineering
ISSN 2052-2576
Vol. 2, No. 1, 2014
www.scholink.org/ojs/index.php/mmse

Original Paper

Modeling the Performance in a Just in Time Context Using Goal Programming Approach

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Abstract

Sustaining philosophical and technological transformations (Just in time production, Total Quality Management, Robotic, New information technologies etc.), requires the evaluation systems of performance that are supposed to play a role of assistance and managerial decision aid, to regularly accompany these transformations. This paper proposes a multi-criteria methodology for global performance evaluation of each enterprise, which operates within Just In Time philosophy that is based on Goal programming from a non-exhaustive set of performance indicators, which reflect the degree of achievement of preliminary fixed objectives (zero stock, zero delay, zero breakdown, zero paper and zero defect),within this proposition a multi-criteria procedure, which takes into account the enterprise specificities, was developed.

Keywords

just in time, performance, multi-criteria approach, goal programming

1. Introduction

Globalization Globalization (or globalisation) as a process of international integration arising from the interchange of world views, products, ideas, and other aspects of culture has touched all world markets. It was reflected by the gradual disappearance of national markets and the creation of regional blocs (ASEAN in Asia and NAFTA in North America). The other face of globalization is the intensification of competition which has become increasingly fierce. The latter has led to a multiplication of the number of products and services, in addition to a reduction in the duration of life cycles. Furthermore, given the multiple mutations that characterize globalization, companies have found themselves in search of strategies to have a consolidated advantage. These strategies represent responses to the requirements imposed by the new environmental data such as, customer satisfaction in less time, manufacturing of various highly personalized products in small quantities. It is in this sense that (Mevellec, 1998), noted that "we are in a time when the problem is to produce what we can sell and not to sell what we are capable of producing. The means of production are becoming flexible and adaptable

to a wide variety of products. “A question then arises, how can companies achieve flexibility? One possible answer is the flexibility to adopt a system of just in time, an industrial production strategy born in the fashion of Toyota plants in the fifties. In production management Just in Time is considered a guiding principle for any industrial organization to increase its flexibility (Marty, 1996). States that the Just in Time “is based on a sound analysis of market needs, a design for wannabes products within production constraints, leading to a dynamic organization of production in the interests of efficiency with maximum reliability and flexibility. “

Just in Time can be considered as a progress approach that aims to eliminate systematically all waste and to seek continuous improvement in productivity and quality. The aim is to achieve the best level of performance. This can be illustrated by observing the performance of adopting companies of this philosophy, specifically the Japanese companies. Since the 1970s, many companies were engaged in a conversion to JIT in order to achieve a high level of performance in terms of cost, time, quality, flexibility and variety. Today companies seek a performance that can meet the expectations and requirements of customers and provide a competitive advantage over competitors.

Thus, to achieve all its objectives, JIT can be a catalyst for business to industrial performance. This performance can be measured by the achievement of agreed targets. It is in this context we perceive the performance of a company by it’s degree of adoption of JIT. To assess the degree of adoption of JIT, we will try to propose a model that relies on mathematical programming goals. This evaluation is assessed using a framework of indicators to measure the achievement of objectives assigned to the processes analyzed.

Our work is organized as follows: The first section will focus on the presentation of the evolution of the management of production to the emergence of JIT. A literature review will present the different approaches and foundations. The second section will focus on the assessment of the overall performance of an optical JIT. This is achieved through a modeling process based on the programming goals.

2. Just in Time

2.1 Overview of Literature

The pressures on companies come from several domains. On one hand through technical progress (automation, computerization, etc.) in addition to the massive increase in the means of production. However, the superiority of demand compared to the supply is compromised. Non - quality has become a factor of poor sales, and customers are demanding more and more. Today if it takes a month for an automobile to be built the customer will believe the time is too long. The motto of consumers today would be: all, immediately, i.e. more time, quasi-infinite choice, optimal quality and low prices.

On the other hand, the abundance of goods strengthens the consumer’s position in relation to the seller. This can be illustrated by an example presented by (Bois, 1988), in the automotive sector, where decision-sale clearly established by the manufacturer has disappeared and we cannot conceive more to

buy a new car without discussing its price. This trend towards the superiority of consumer is spirited to accentuate especially with the exponential development of information dissemination.

The other external constraint is related to the competition. It was amplified by the globalization of trade and the development of information; cite the example of the automobile in France between 60's – 70's, which had for competitors on the national market four marks, now it takes five German (VW, BMW, Mercredes, Ford, Opel), one Italian (Fiat), two Swedish (Volvo, Saab), one American (Chrysler), two Korean (Daewoo, Hyunday) and several Japanese (Honda, Toyota, Nissan, ...). So there is a strong tendency to increasing the number of competitors. This is due, firstly, to the progress of information, and secondly, the fact that emerging countries learn quickly and have considerable financial power which enables them to make important investments and have cheap labor. The best example of this phenomenon is the Korean Industrial Daewoo, which, through judicious alliances, was able to extract the know-how of some Western societies in areas of advanced technology (e.g., a joint venture with General Motors) and was able to use the support of the Korean government (considerable debts). In addition, as soon as a sector shows promise, the phenomenon of imitation occurs by a large number of companies. This leads to a great necessity of extreme responsiveness of each company in terms of product renewal and permanent adaptation to markets in which companies retain a competitive advantage. The last constraint touches the financial aspect. In previous years, it didn't have an important role while today it dominates the entire life of the enterprise. This metamorphosis is due to several parameters. First, investment has increased significantly in recent years: automation, computerization, etc. ... where once the workforce constituted the principal expense of the enterprise. In addition, since 80's shareholders required an almost immediate return and discouraged long term investments. This growing requirement of shareholders for achieving immediate profitability pressured managers toward reducing the stocks, assets and payment delays. Otherwise, the work of (Bois, 1988), have shown that there is a changing attitudes of banks facing investment in business. They have evolved towards a greater prudence. A big project is not financed today unless more banks will associate.

In response to these pressures, companies will have to produce faster with an increasingly low stock, ensuring positive margins with a very large range of products and offers quickly renewed. This requires the enterprise to be more flexible and responsive. To achieve this flexibility, the JIT could constitute a solution. This model was developed at Toyota at the initiative of a leader (OHNO, T) which has shown that it is possible to produce economically diversified industrial products in short series than standardized products in large quantities. In the same spirit (Ohno, 1989), points out that "There are hundreds of people in the world who are able to increase productivity by increasing the quantities produced, but few people improve productivity when the volume of production decreases. People like to work less to produce more and loath to work more to produce less. "

A study realized by Bounine, Jean et Kiyoshi Suzaki, showed that "since the beginning of 70s, manufacturing industries occupied, in Japan and in France, roughly the same proportion of the working

population to the order of 24.5% in 1983. In contrast, productivity that is the added value or the wealth produced per employee of these industries which in 1970 was lower in Japan than in France, ten years later became almost more than half." The diffusion process of JIT started at the first congress which was devoted to discussing the techniques of just in time as the first World Congress of the production and control of stocks organized in Vienna in May 1985. At the same moment, some U.S. subsidiaries of Japanese companies had adopted the JIT. In the same context, Raymond Lévy the President of the Renault company announced to the European Parliament that "the improvements that could be made to our system have attained their limits, and mass production is not the solution, it has been dethroned by lean production whose principles were defined at Toyota as fewer men, less inventory, less time per car produced and on arrival less defects" (1).

The idea of production in Just in Time (JIT) seems essential to explain the productivity gains. The principle of Just in Time is simple " Produce and deliver finished goods Just-in-Time to be sold, sub assemble just-in-time to be assembled into finished goods, fabricate parts just-in-time to go into the sub assemblies and purchase materials Just-in-Time to be transformed into fabricated parts " (2).

2.2 Definitions and Basic Concepts

Today, despite the publication of numerous books and articles on the JIT, many definitions and pseudo-synonyms exist and sometimes give rise to different interpretations sometimes divergent.

On the Etymological map concept JIT can be husked in two "Just", and "Time". The first term gives an idea of just what quantity we need, just necessary no more, no less. The second term gives an idea of the time when it is needed that is to say no before or no after. Thus, to understand this concept (Just in Time), we will begin by studying an often presented confusion between "Just in Time" and "tight flows". We note here that these two terms refer in fact to the same object. Except that the first refers to a process and the second to its result.

According to Colin, R., The tight flows designate the result of the mechanism of Just in Time. If it has been correctly executed inside a plan, as well as between this one and its partners in the process of production (upstream suppliers, distributors for downstream and service providers) then flows are perfectly straight. We could define the tension of the flows by the fact that all people, machines, parts, raw materials, information are used to realize strictly the command determined by the commercial service, and that nothing is done which would be similar to a waste to an operation at which none real demand does not correspond"

On the other side, any firm applying JIT seeks to organize its production process according to new economic data imposed by the environment, by the production of what is already required by the consumer downstream and upstream according to manufacturers' punctual needs. Carillon, J-P.,

(1) THIERRY, G : " Sauve qui peut : l'automobile ", Revue le nouvel observateur, octobre, 1991, p. 28.

(2) VERAN, L :" La prise de décision dans les organisations, réactivité et changement ", les éditions d'organisation, Paris, 1991, p.67.

schematizes the Just in Time as “a system of pilotage of interfaces: - Interface with the distribution and markets, - Interface with production, - Interface with product definition and business - Interface with the environment - interface with suppliers.”

On the other hand, Calvi, R., defines JIT as “the use of a set of practices or tools to simultaneously improve business agility and reduce inventory, while favoring the diversity of its production.”

Furthermore, Marty, C., Courtois, A., Laverty, Jacques et Rene Demeestere, share the same idea as they summarize the JIT in an “industrial philosophy” aimed toward increase in competitiveness.

The different definitions reveal the difficulty in framing the definition of the JIT concept in a short and complete definition. Several studies have been conducted to synthesize the various practices of JIT in order to assist users to easily conceptualize the concept.

Thus, we can consider the JIT as a culture to develop within the company. This culture makes reference to a gradual process and continuous improvement by producing only the product that can be sold at the right quantities, when and where needed.

2.3 Inadequacy of Traditional Management Tools

Due to the evolution of production systems and production management toward a synchronized and integrated production the system of performance measurement related to production is questioned. Traditional tools, such as cost accounting, budget control, were developed when the industrial performance was principally related to minimizing products costs (Taylor’s time)

According to Mevellec, P., the traditional measure of performance has not adapted to changes in the environment that is the new market characteristics. When price is the only component of the value of a product, the cost analysis system allows following the performance of the company. But, with a view of the JIT, we know that the value is synonymous with price, quality, delay, and variety. Hence the cost analysis system does not bring sufficient answers to decision-makers. Chang, D., and Lee, S. M.explains that the method of calculating total costs and specifically the choice of key of the distribution costs and work units (labor hours, time machine ...), no longer allows to have a clear view of the economic performance of a production system. The basis of an effective pilotage of a production system resides in precise, complete and adapted information to the decision making. Therefore, today the system based on traditional tools is unsuited to the different needs of performance evaluation.

Karlene, M. C., and Cox, J. F. proposed to complete the measurement of the performance of the production system, the implementation of physical indicators. Indeed, the monthly statement of quality control, the average duration of operations, the percentage of deliveries in time, the stock level, the processing time, the time of introduction of new products constitute a pertinent set of measurement performance. The addition of physical indicators responded to the needs to provide a complete and multi-criteria measurement, regrouping economic indicators and physical indicators. It does not define a set of indicators, but a true system of performance indicators whose finality is the pilotage of industrial performance. AFNOR describes a performance indicator as a quantified data which measures the effectiveness or efficiency of a process or system, compared to a standard, plan or a defined and

accepted objective, in the context of an enterprise strategy. That is why it is necessary to establish a veritable system of performance measurement, adapted to the needs of decision makers that is able to evolve.

Laverty, Jacques et Rene Demeestere proposed (see table below) a comparison between the performance evaluation systems of a traditional production system and a JIT system.

Table 1. Comparison between the performance evaluation of traditional production and JIT systems

Traditional system	Just in Time system
- Major Objective: short-term outcome	- Strategic Objectives
- Follow-up costs, responsibility center	- Followed by physical indicators very close to the industrial process : generators cost, the key factors to achieve the objectives
- Local optimization: indicators by responsibility center	- Global Optimization: indicators for central and shared indicators.
- The same indicator is used at all centers	- Indicators adopted with specification centered to priorities of the company
- The system is frozen in time.	- The system is evolutive
- The system is defined by the management	- The system is defined in concentration with all responsibility
- Focuses on efficiency, utilization rates and productivity of labor, and on using machine by post.	- Focuses on the overall productivity: number of hours / product, focuses on time, quality, linearity, stocks, reducing breakdowns.
- Privileges the volume.	- Privileges the adaptation to demand
- Individual performance.	- Performance per Group
- Little control overhead	- Reduced overall cost by action on the generators of cost.
- Demarche turned toward the past: observation a posteriori differences between actual cost and standard cost.	- Demand turned towards the future, research of permanent progress, action plans to improve performance indicators

3. Modeling of the Performance of a JIT System

3.1 Objectives of JIT

Any company that engages in a process of JIT aims toward achieving specific objectives such as: zero defects, zero delays, zero breakdowns, zero paper and zero stock.

3.1.1 Zero Defects

The golden rule of an organization JIT is to produce only when it is satisfied "production without defect". In this logic, quality is a cornerstone of the production. Design defects, rework and scrap, breakdowns for customers are sources of waste. In summary, zero defects is based on all the tools and methods of quality in order to minimize waste.

3.1.2 Zero Delays

Production at zero stock necessarily compresses the response time of plants, including those of suppliers. Reducing the overall time required for the JIT. For example, the deadline of a new product to be placed on market must be mastered, since it allows the company to have a monopoly for some time.

Furthermore, intended deadlines must be respected. Mastery of delays engenders a reduction of production cycle, administrative delays, and transport time enterprise / customer.

3.1.3 Zero Breakdowns

This objective concerns the management of equipments and their maintenance. At this level, the Japanese developed procedures and techniques called "Total Productive Maintenance" (TPM) based on the following five conditions:

Fill out the basic conditions of maintenance

Respect the conditions of use

Rehabilitate equipments soon as they degrade

Repair after breakdowns and take the opportunity to understand the deficiencies of equipments and improve their design

Continuously improve the procedures of maintenance, while preventing human errors that occur during operations and / or repairs.

3.1.4 Zero Paper

Zero paper refers to the information system. It can refer to different aspects. The first concern is the simplification of administrative systems, the removal of redundant forms and signatures cascade. The aim is to achieve a more flexible organization and readability of decision-making centers. The second angle is to ensure better management of information by removing redundant information through quick access to information, reliability and updates to the remaining information. Hence, there is a shift towards the computerization of information flow. Physical circuits of information are replaced by flows of electronic data interchange (EDI). Plans and technical data are managed by technical data management systems, quality procedures and documentation by document management systems.

3.1.5 Zero Stock

"Stock is evil," they say in Japanese companies practicing JIT. Stocks should be avoided because they are wasting countless sources. But it should be noted that stocks do not exist because of the same reason and they should be examined differently. This is why the term zero stock should be taken as a reasonable incentive to reduce stocks. Although there are no formal methods, the preferred approach is the reduction of Inventories of supplies that can sweep a set of problems relating to the functioning

(quality, reliability...) that will emerge when stocks go down. Another approach is concerned with reducing delays but it should be noted that the stock and time are closely related and can hide the same problems.

Operationalization of these specific objectives can be achieved through a set of indicators. A review of the literature (particularly the work of Laverty, Jacques et Rene Demeestere allowed us to identify below the following Just in Time indicators.

3.2 Just in Time Indicators

3.2.1 Indicators of Zero Defects

- Number of quality claims
- Units returned by customers
- Number and rate of rejected parts
- Number and rate of reprocessed parts
- Results of tests of quality parts delivered
- Number and rate of suppliers in quality assurance
- Costs of prevention, evaluation of no conformity
- Warranty costs
- Absenteeism
- Losses materials

3.2.2 Indicators of Zero Delays

- Manufacturing time / of shipping,
- Efficiency of the cycle = ∑ operating time / manufacturing time,
- Flow linearity = (∑absolute deviations between good quantity produced - quantities planned in the program) / ∑ quantities provided in the weekly program,
- Reduced dead time (transfer time, waiting time, preparation time, time to change tools and time to control),
- Product design (number of components),
- Plant organization (number of movement, number of intermediate storage points and costs of handling),
- Process design (number of operations, operating time, number of tool changes)
- Respect time limit (number and rate of late deliveries, incomplete, claims deadlines, cancellations of orders),
- Time (average processing time),
- Respect manufacturing program (standard expected / achieved)
- Manufacturing time (time of exceptional manufacturing),
- Forecast Accuracy (standard expected / actual)
- Partnership with suppliers.

3.2.3 Indicators of Zero Breakdown

- Reducing hazards (breakdowns, preventive maintenance, repair, non-quality)
- Ease of fabrication (cost of launching, first quality manufacturing, material losses, duration launch phase)
- Simplicity of products (number of components per product, number of operations per product, number of tools used)
- Standardization of components (number of components used in several products, number of products / number of components)
- Quality of design (number of changes, changes in product specifications)
- Reduction of bottlenecks
- Availability of resources
- Rate of commitment
- Respect for deadline, and
- Recourse to simple machines.

3.2.4 Indicators of Zero Paper

- Reduction of exchange of paper documents,,
- Flexible Organization
- Quick access to information
- Effective Communication
- Electronic Data Interchange EDI Progress
- Reducing the number of suppliers.

3.2.5 Indicators of Zero Stock

- Value and rotation (number of days of supplies) in stocks of raw materials
- Value and rotation (number of days of production) of outstanding
- Value and rotation (number of days of production) in stocks of finished products
- Performance of flows
- Quality of forecast (deviations forecast / achievement, demand fluctuation)
- Standardization of components (number of components / number of products)
- Just in Time Delivery (delivery frequency, delivery time, packaging deliveries ready to use, deliveries directly off workshop
- Late and incomplete delivery (respect of deadlines, number of retries suppliers, number of exceptional transport)
- Quality (number and percentage of suppliers in quality assurance, result of quality tests, incident on parts supplied).
- Based on these operational indicators, we can start modeling activities to measure performance as the degree of adoption of JIT.

3.3 Evaluation Model of Performance of a System in Just-in-Time

We discussed previously that achieving industrial excellence passes through the realization of five Zeros. Zero defects is a reflection of the quality control of products and processes. Zero breakdown results in equipment reliability. The zero delay is summarized by the flexibility of means of manufacture and organizations. Zero stock is presented by the effectiveness of management and finally the zero paper is interpreted by the speed and quality of communications.

3.3.1 Conceptualization and Formulation

The literature review has allowed us to translate the objectives of JIT into five operational and quantifiable dimensions. It should be mentioned that, taking into account the quantification of the five zeros of JIT represents only a ideal situation, possibly hypothetical and are in no way considered as absolute values.

The design of the model that we count developed is based on the reduction of the differences between the practices (achievements) and predetermined goals in a context of perfect adoption of JIT. The analytical translation of this design can be accomplished through multi-objective mathematical programming (especially goal programming). To these five specific objectives performance indicators correspond that were the subject in the previous section. In our work, we will try to evaluate the degree of adoption of JIT through a modeling process which is based on mathematical programming by goals (Goal Programming). Goal programming was developed by Charnes and Cooper in 1961 in its linear form, and then popularized by applications of Lee (1972, 1973), Lee and Clayton (1972) and Ignizio (1978). This technique has undergone several extensions and diverse applications. As application area we can cite, for example, marketing and quality control (Sengupta 1981), human resources (Price and Gravel, 1984), production (Lee et al 1978 Dekro 1984), transportation and location (Charnes et al., 1996), decision support (Aouni.B, 1997), etc.. On the other hand, the mathematical programming model by goals had several variants, such as weighted Goal Programming, Lexicographic Goal Programming, nonlinear Goal Programming, fuzzy Goal Programming, and Stochastic Goal Programming.

In a decision context, Goal programming can simultaneously consider multiple objectives in a most satisfactory issue of choice of action from a set of possible actions (the set of feasible solutions). More specifically, this model consists to find a solution that minimizes deviations by reporting the goals set by the decision maker for each objective.

The standard analytical formulation of the goal programming can be represented as follows:

$$Max \sum_{i} \left(\xi_i^+ d_i^+ + \xi_i^- d_i^- \right)$$

Subject to :

$$\sum_{j} c_{ij} x_{ij} + d_i^- - d_i^+ = g_i$$

$$\sum_j c_{ij} x_{ij} \leq b_i$$

$$x_{ij} \geq 0$$

Where:

x_{ij} : Decision variables of the problem,

c_{ij} : Technological coefficients of decision variables,

g_i : Previously goals set,

d_i^+, d_i^- : Positive and negative differences between the previously set goal and achievement,

b_i : Right side of the structural constraints (availability, etc..)

ξ_i : A real that takes the form of a conversion coefficient of a weight or priority associated with goals.

The goal programming model as presented in its standard form ignores preferences of decision maker and let it with regard to the optimization process. To fill this weakness of the standard model (Martel et Aounii 1990) introduced the mechanism of satisfaction function that integrates several factors reflecting the preferences of decision maker. The objective function of the model GP-1 can be written as follows:

$$Max \sum_i \left(\xi_i^+ F_i^+ \left(d_i^+ \right) + \xi_i^- F_i^- \left(d_i^- \right) \right)$$

With:

F_i^+, F_i^- : Represent the functions of satisfactions on positive and negative deviations from the target i.

3.3.2 Performance Evaluation of a JIT System

For performance evaluation, we selected three typical situations the the unwinding of a process of JIT. For each situation, an evaluation model is proposed.

a. Situation 1

The first situation concerns the case where the objectives (dimensions) of JIT have the same importance during the unwinding of the process of JIT. Thus, the formulation of this situation can be written:

$$Max \sum_{i} \left(F_i^+ \left(d_i^+ \right) + F_i^- \left(d_i^- \right) \right)$$

Subject to:

$$\sum_j w_{ij} x_{ij} - d_i^+ + d_i^- = g_i$$

$$\sum_i \sum_j w_{ij} = 1$$

$$w_{ij} \geq 0 , \ d_i^+ , d_i^- \geq 0$$

Where:

x_{ij} : Quantitative value of what has been achieved by the indicator j at goal i.

w_{ij} : Conversion factor which can also be interpreted as the weight.

g_i : The goals previously fixed (all of these goals can be without measurement unit, we will convert it into neutral unit but associated with a dimension).

d_i^- : The negative difference between the previously established goals (g_i) and achievements.

d_i^+ : The positive difference between the previously established goals (g_i) and achievements

In this model, the interest oriented towards determining w_{ij} which minimizes the difference between the pre-set objectives and targets achieved. In fact, it is to identify w_{ij} the most favorable point of view of enterprise to improve the current situation. Performance is reflected in the difference expressed in the objective function.

b. Situation 2

This is the situation in which company does not give the same importance to all the objectives of JIT. In this case, it tries to focus on the one for which it is the most capable of improving its performance. For example, it can choose to be innovative and focus on the quality of its products; it can focus on flexibility to meet a demand subject to significant fluctuations or also the reliability to meet delivery requirements.

This focus does not mean that the company will ignore lower priority objectives, but rather it seeks to stand out from their competition by targeted objectives (order of priority). For example, the company Rolls Royce retained the following order: quality $\Rightarrow$ Time $\Rightarrow$ quantity $\Rightarrow$ cost. On the other

hand, an armament company has retained the following order: Time $\Rightarrow$ quantity $\Rightarrow$ place $\Rightarrow$ quality $\Rightarrow$ cost.

The formulation of this situation can be written as:

$$Max \sum_{\mathrm{i}} \left(\xi_i^+ F_i^+ \left(d_i^+ \right) + \xi_i^- F_i^- \left(d_i^- \right) \right)$$

Subject to:

$$\sum_j w_{ij} x_{ij} - d_i = g_i$$

$$\sum_i \sum_j w_{ij} = 1$$

$$w_{ij} \geq 0 , \ d_i^+ , d_i^- \geq 0$$

This mathematical program seeks to minimize deviations from the goals for each objective, taking into account the priorities expressed by the decision maker. The procedure for resolution of this model is to minimize (in order) the differences between objectives and achievements. Initially minimizing concerns for the most important goal (priority). The difference found in relation to the priority objective will be considered as a constraint in the minimization program (the second time) of the difference of the second objective, and so forth (sequential and iterative procedure).

c. Situation 3

In this model, the decision maker can assign a weight (reflecting the relative importance) to each objective (dimensions) used. Thus, a high importance coefficient α_{i} indicates that the decision maker penalizes the deviation relative to the objective.

The formulation of this model can be written:

$$Max \sum_{\mathrm{i}} \left(\xi_i^+ F_i^+ \left(d_i^+ \right) + \xi_i^- F_i^- \left(d_i^- \right) \right)$$

Subject to :

$$\sum_j w_{ij} x_{ij} - d_i = g_i$$

$$\sum_i \sum_j w_{ij} = 1$$

$$\sum_j W_{ij} = \beta_i^+ \mathrm{W}_{\mathrm{i}}^+ + \beta_i^- \mathrm{W}_{\mathrm{i}}^-$$

$$\beta_i^+ + \beta_i^- = 1$$

$$w_{ij} \geq 0 , \ d_i^+ , d_i^- \geq 0$$

Where

ξ_i : Weight assigned to i^{th} objective.

To circumvent the difficulty of aggregation (sum of different types of entity in the objective function, significant fluctuations of observations), we can propose the standardization of data. For this purpose, different techniques are possible:

- Divide the value of each indicator by its standard deviation.
- Divide the value of each indicator by reference of sector:
- Focused and reduced.
- Divide the value by the maximum value.

In summary, the development of the proposed methodology includes: First, a step of selecting the operational indicators of performance evaluation. Second, a step of standardization of scores achieved. Third, a step of identifying the position selected. Fourth, a step of resolution of the selected models. Finally a step of operating results (performance evaluation and generation strategies).

4. Conclusion

To respond to new requirements of the industrial competitiveness, companies are required to learn to control their industrial policy to regularly improve their levels of cost, quality and flexibility. For this purpose, a new methodological approach of organization and production improvement is recommended: Just in Time. Just in Time is a response to the crisis of industrial organization inherited from the era of mass production.

The JIT allows responding to the complex needs of the market by procuring the requested goods in quantities requested, at the right time, with the quality required for a minimum price. The production system in JIT is the answer, among other things, of the question posed by Ohno “What to do to elevate productivity, while the quantities do not increase?”

Progressively, the JIT has become the international reference for the industry solicitous to cope with markets evolution. Gains brought through this production system to industrial enterprises (who knew how to apply it) were so high, that, since the early eighties, numerous U.S. and European companies have adopted the conversion to this system. The current emphasis in industrial management is that the JIT is located at the forefront of the debates which falls under the research of industrial performance.

To respond to this preoccupation related to enterprises performance, we propose a modeling approach based on goal programming which evaluates the degree of adoption of JIT. The modeling activity proposed comprises three steps. First, we delimited the conceptual framework of performance evaluation as an optical of JIT by considering an “ideal” situation from which the company will be positioned. Second, the analytical translation of the previous conceptual model was realized via goal programming. At this level, we operationalized the dimensions of JIT by quantifiable indicators. Third, the resolution of the formal model leads on one hand, to the evaluation of performance (according to

the optical of JIT) and on the other hand it generates strategies (or action) leading to improved current performance.

Our activity of modeling, allowed us to identify three typical situations of conduct of a Just-in-time demarche, according to the order of importance of the objectives of JIT and / or the relative importance of performance indicators.

The modeling activities carried represents only a proposal demarche whose potential fits the reality and its improvement is an essential field of investigation.

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