# MANAGERIAL DECISION FOR ECONOMIC ORGANIZATIONS, JUSTIFIED BY REASONING, ALGORITHMS, PROCEDURES AND PARADIGMS SPECIFIC TO EXPERT SYSTEMS

***Marian-Sorin IONESCU[a]****

*[a] University Politehnica of Bucharest, Romania*
*E.P.F.L. Lausanne, Suisse*

**ABSTRACT**
*The extremely complex problem faced by the modern economic organization in the search for the development of the higher added value, the financial profit, positioned in a very dynamic human eco-system, with a high degree of uncertainty, determines that the current operational trends but also the development strategies subsequent decision-making processes to be positioned on the latest achievements of world technical-scientific progress.*
*The concepts and paradigms of the digital approach are considered at the moment, along with Artificial Intelligence, Deep Learning, Machine Learning and expert systems the most active vectors in understanding, elaborating and developing the decision of the top organizational management.*
*The operational business activity, irrespective of the economic environment in which it is positioned, practically becomes a decisive functionality with a scientific foundation and a subsequent technological implementation.*

**KEYWORDS:** *Artificial Intelligence, Deep Learning, Expert System. Machine Learning*

## 1. INTRODUCTION

Intelligent solutions, expert systems are developed and functional in a multitude of sectors of modern human activity, the arguments they imposed are the explanatory force developed by them and the flexibility of symbolic reasoning. (Murphy, 2012).
Thus, a general picture is accessible on the methodology of the expert systems, but also on the economic history of the business models chosen and implemented at organizational level.
Even though the approach of the managerial decision problem with the help of expert systems is a relatively new methodology, they have already reached a relevant degree of operational maturity, in order to offer concrete benefits in the vast majority of their correlation with the current business models.
In the operational-strategic tactic of obtaining the decision of the top organizational management, we identify at the computer level two platforms that are used to implement the necessary and sufficient business rules.
The number one platform is the one that directly accepts the semantics of business rules, business, the number two platform is a typical inference platform that directly supports engines with complex commercial inferences (Russell & Norvig, 2003).

* Corresponding author. e-mail address: *sorin_ionescu_07@yahoo.com*

Specifically, the approach of the rules required by the business model agreed by the economic organization is a set of new paradigms, algorithms and technologies, which are based on the first perspectives being relevant for the entire economic process, intrinsic and extrinsic, in all its complexity.
We also note that approaching business rules is naturally easier to connect with certain particular classes of platform than with others.
Considering that engines with specific commercial inference are very easy to implement and use with the rules, they define one of the remarkable classes of platforms for the operational implementation of expert systems dedicated to economic phenomena, while also offering the possibility of developing an optimization mechanism for certain types of challenges.
It should also be mentioned the existence of other types of platform for computers, which reject certain rules within expert systems, not necessarily and but excluding the rules of inference, for this reason, this lot of platform is not really an "engine of the rules of business", the working time given to the development of events, making a clear distinction from the inference engine.
Such an engine is not necessary to be involved in the decision making process, it operates independently in real time, due to the occurrence of economic events with a high degree of relevance, i.e. changes in the knowledge states.
For such a platform significant advantages can be identified within the implementation of business models with a high degree of repetitiveness, productivity, adaptability, flexibility.
Generally, in the business processes there are a multitude of events to change the knowledge, data, relevant for each rule within the chosen expert system, an evaluation process becomes absolutely elaborated.
In the semantics of rules, their system must possess the ability to analyze any rule, it follows an association of each event for a certain mapping rule, a facility for its use as a general rule engine.
The mapping phenomenon facilitates access to the relevant rules given to an event that gives rise to a particular interest, the engine is the one that determines if any rule associated with that event is not satisfied.
As a characteristic of the business models, we meet the approach of the analysis "possibility (means) - purpose", the reasoning developed by the elaboration of the managerial decision is motivated by the purpose to be reached, as an alternative of removing possible inferences.
The inference, in this type of approach, is the one that extracts an immediate consequence, a particular information from a given process status presentation.
This paradigm is a form of the logical processes of "subsequent chain" deductions, which significantly increased the efficiency fence of the top managerial decision adopted at the level of economic organization.
The business models are understood, interpreted, modeled, transposed operationally-strategically in a form accessible to the top organizational management, with the help of a thorough knowledge of the concepts, principles, algorithms and procedures specific to the paradigms of Artificial intelligence, of which we present in the following "inference with back links".

## 2. INFERENCE WITH BACK LINKS

The procedure taken from the scientific field of competence of Artificial Intelligence, transposed on the operational structure of the modern business models, requires first of all the specified "target", followed by the application of all the possible rules in the sense of "posterior" action, to reduce the dimensionality of the environment. activity and identification of intermediate targets, it must be emphasized that through its structure each environment allows the development of an inference with the given purpose target (Russell & Norvig, 2003; Murphy, 2012).

Developing an iterative type process, each sub-target is reduced again, which leads to inference with back links; the process is applicable until it is stopped when no rule is applicable to the set of sub-targets or when the sub-target set is completely satisfied with the analyzed database.
Addressing the situations in which the business model implemented at the level of economic organization is positioned, it suggests that the loggia of the proposals is the one that offers correct answers for all the possible challenges, internal and external - business environment.
The sentence logic offers a unique way of representing all the knowledge related to specific situations in which the used business model is positioned.
A degree of insufficiency for a comprehensive description of the general knowledge is present, which is a direct consequence of the lack of notions of process variables.
The introduction of the variable in the business models that describe an economic process, offers the possibility of granting the truth value for a sentence, if it is true for all possible replacements in the case of a given variable.
By quantifying the predicates used, the variant of the use of variables as substitutes for concrete cases, examples from the specialized market, the mathematical quantifiers are those that define the variables intrinsically.
First-order predicates are defined with the help of quantifiers:

(i) ∀, universal quantifier, it offers a true proposition for all the variants in which a P (x) expression is verified, whatever the values within the domain $x$;
(ii) ∃, the existing quantifier, offers the degree of truth of a proposition for whose interpretations there is at least one value (state) within the set x that verifies the expression $P$;

Predictive calculation (Faltings & Schumacher, 2017), with value quantification allows to make the distinction of ambiguity that exists in the expression of the desire of the final consumers (end-users):

$$(\forall, \exists)[Consumer\ (x) => Wish\ (x, Quality)],$$

"*All consumers want quality products*"

$$(\exists, \forall)[Consumer\ (x) \wedge Fac - a\ process - of - selection\ (x)],$$

"*There is at least one consumer who selects their desired products*"

Starting from the statement specific to the field of scientific marketing competence,

"*All the consumers have a favorite product in each specialized market*"

Is also represented in the form:

$$(\forall\ x)person\ (x) => (\exists\ y)(product(y) \wedge wish(x, y))$$

$$(\exists\ y)product\ (y) \wedge (\forall\ x)(consumer\ (x) => wish\ (x, y))$$

The type of quantification allowed, for the approached marketing problem, offers a difference in the calculation of the predicates needed for this problem:

(i) Order 0: no quantification is possible;
(ii) Order 1: quantification is at the individual level;
(iii) Order 2: quantification is at the individual level and predicate;

The inference algorithms, (Faltings & Schumacher, 2017), usable in business models exist uniquely for order 0 and order 1, predictive calculation using order 2 is never used, it is necessary for the expression of knowledge such as:

"*All carbonated beverage qualities remain valid even on Inter Planetary Cosmic Ships*".

In implementing such structures specific to expert systems, for the business models implemented operationally at the level of economic organization it is necessary to introduce a function that eliminates all the existential quantifiers, namely the *Skolem Function*.
We consider an existential quantifier that is assigned within a domain of another universal quantifier, according to the following formalism, $(\forall x)[(\exists y)p(x, y)]$, the *Skolem function* is

introduced, $f_y(x)$, this returns for each x a y, so that p (x, y) is true, so the expression is correct $(\forall x)p(x, f_y(x))$.

Within the chosen business models, treated with the help of propositional logic, (Pearl, 2009) we use the differentiated *Skolem Function* for each existential quantifier and all the variables with universal quantification, including intersection domain with that of the existential quantifier, which become argument of the function used (Russell & Norvig, 2003).

Continuing the application on the previous example, it turns out that the expression $(\forall x)person\ (x) => (\exists y)(product(y) \wedge wish(x,y))$, undergoes an intermediate transformation into $(\forall x)person\ (x) => (product(f_{product}(x)) \wedge wish(x, f_{product}(x))$, which finally becomes $person\ (x) => (product(f_{product}(x)) \wedge wish(x, f_{product}(x))$.

We identify three remarkable characteristics of this type of approach to economic phenomena using the tools specific to Artificial Intelligence, (Faltings & Schumacher, 2017), (Kowalski, 1979):

(i) Direct application of the significant knowledge (data) for the economic model - unification; for new proposals with a certain degree of representativeness to be deduced from a lot of data consequence of other proposals, there is a need for quantified knowledge, valid in general, operable for the desired application;
An inference engine is the one that has to identify correspondents between a representation of the quantized data and the representation of a sentence, the expression of the correspondents is made by values given to the variables that appear in the quantized form, this determination is the object of a filtering mechanism, *Pattern Matching* and more generally of the *Unification*;

(ii) The Mechanism of *Pattern Matching* is the one that filters once with the help of an expression that may contain variables-the filter as such, thus the correspondents-relationships, data-filter are developed;

(iii)The last remarkable feature is *Unification*, it corresponds to the filtering mechanism for which it is admitted that the intrinsic data contain equally variable, and not only filtering characteristics;

We notice that an algorithm with back links, used in applications on operational-strategic business models is relatively complicated to implement in a manner with a high degree of efficiency, if the multitude of connections between intermediate targets and the environment in which it is positioned is taken into account the economic organization studied, (Falting & Schumacher, 2017), to prevent the doubling of the decision-making effort:

(i) If each target is approached in isolation, distinct from the rest, the response obtained is more than necessary, it must uniquely satisfy one of the requirements of the generated environments;

(ii) If the approach to each environment is of an isolated nature, disjoint to the rest, the effort is repeated for each intermediate target that appears in more than one environment;

## 3. THE INFERENCE ALGORITHM FOR ORGANIZATIONALBUSINESS MODELS

Approaching business organizational models with the help of inference algorithms is currently experiencing multiple development, from direct operational-strategic applications, digitization of operations, meeting the needs and wishes of final consumers.

These are modeling approaches, focused on programming business models in multiple platform representation, agnostic; we identify a possible break in communication between software developers, engineers, technical experts, economists, who have an approach positioned on other paradigms of the phenomenology met and the decisive manager, under uncertain conditions.

Algorithms and procedures specific to inference, allow the connection of several partial datasets into a functional unit of global dimensions, subsequent model transformations are perfectly generated for several types of platform without any further software interference (Dechter, 2003).
Below we present an algorithm with a high degree of generality, perfectly adaptable to a variety of business models, for an inference engine with back links (Falting & Schumacher, 2017).

1: *Rear Links function*$(R, F, B)$.
2: $envs < -\{target - initial\} = B$
3: ***reapeat***
4: $e < -first\ (envs), envs < -rest\ (envs)$
5: ***if*** *all his targets are reached* ***then***
6: ***return*** $immediate(target\ (s), unifiers(s))$
7: ***for*** *the totality of the targets* $b \in$ ***edo***
8: ***for*** *all sentences* $p$ *from the database* $F$ ***do***
9: ***if*** $U < -UNIFIER\ (p,b) <> ECHEC$ ***then***
10: $add\ (e \setminus b) \cup U$ *to line envs*
11: ***for*** *all the rules* $r$ *from the rule base*$R$ ***do***
12: ***if*** $U < -UNIFER\ (right\ (r), b) <> ECHEC$ ***then***
13: $add\ (e \setminus b) \cup immediate\ (left(r), U)$*to line envs*
14: ***until*** $envs = vacuum$

## 4. SOLVING THE PARTICULAR PROBLEMS OF DIFFERENT BUSINESS MODELS

We find a process of similarity between the diagnostic analysis, the interpretation of the data and the final and intermediate targets from the problems arising as a result of using the organizational business models.
The access to data, their interpretation and hierarchical structuring involve processes that require significant financial allocations for any operational business entity, a feature of expert systems is that they generate a good financial but also a technological economy, the call to this type of information is made only if certain particularities of the business process or other specific considerations are sought.
The algorithms and procedures taken from Artificial Intelligence, internal organizational mechanisms are created and operated that allow the generation of an Application Process, explicitly, rigorously, which requires a quantitative and qualitative supplement of information for a specific need that has to receive an effective answer (Rossi et al., 2006).
As a particularization of these situations, the expert systems used in marketing studies, which follow the behavior of the final consumer, require additional information about them, such as age, frequency with which they access certain commercial locations for sales, depending on a certain type of products, behavioral particularities.
The information of the type and structure of the previous ones is obtained generally on micro-interviews put to the real users but also potential, a means of communication not always very correct and efficient.
Approaching through the paradigms of Artificial Intelligence, proposes for such a challenge, providing all the information necessary to solve the problem arising with the help of a bias belonging to a graphical interface.

## 5. THE INFLUENCE OF EXPERT SYSTEMS ON THE DECISION OF THE TOP ORGANIZATIONAL MANAGEMENT

Expert systems, (Baader et al., 2003), are most often aids in the complex and broad process of managerial decision making, with subsequent strategic consequences with a high degree of importance, for example, intelligent robots such as ASIMO, developed by the HONDA corporation, have the ability to understand and operate certain specific aspect of the production management, logistical processes and business activities, is a useful tool in creating forecasts regarding the increase of the profitability of a business, or the risk of its bankruptcy.
In this type of forecasts, with possible serious consequences for the analyzed economic entity, expert systems do not have to be the justifying factor of the decision, they are part of a mechanism with a high degree of complexity, in which the data, databases, deposits of data, are the subject of a fundamental procedural study but also of a human-machine dialogue, the human decision maker is the one who has the final choice and the responsibility of validating the computer's recommendations before they are transposed operational and strategically.
In the case of expert systems structured on previously specified rules, each conclusion appears as a consequence of a set of rules developed from an initial information, this ordering of the rules in the form of a string are expressed in a natural language, used as a subsequent justification for the results obtained.
In current managerial practice, they are delivered to the user as a direct consequence of an interactive dialogue, the intermediate results, steps towards the final result, appear as a consequence, one after the other.
Mechanisms analogous to those of expert systems used in business are identifiable for expert systems operated in medicine, such as, MYCIN, from where trans disciplinarity is observed and at the same time convergence of different areas of scientific competence of human activities.
Similar mechanisms MYCIN, following requests of the type WHY and HOW allow the provision of concrete explanations for each question with the help of a preferred system rule to be applied for a multitude of concrete situations, operational within the specialized market.
In expert systems, the rules correspond to the diagnostic assumptions that the systems try in a continuous effort to verify them.
The previous logical positioning offers a correct explanation of the paradigms that require a data test, it is often not enough.

## 6. THE DECISION, CRITERIA PROCESS

The approach of the business models with the help of the rear linking is most effective for the well structured problems from the point of view of the final and intermediate targets through planning or diagnostic processes, the forward chain is the one that has a higher degree of adaptability in the case of that the managerial decision needs an interpretation of data, presenting at the same time a simplified degree of implementation within the operational I.T. entities, at the level of each economic organization.
The process of choosing glove (ties) in front versus gloves (ties) is structured on the basis of the type of rules, what-more-expensive (x) => more-expensive (? X, ? Y), forward links in a unique way , because the forward chain requires the unification of an infinite number of individuals, final human consumers, $End - Users,$ analogous the process is approached by chain (link) in front, $cola\ (?x, ?y) => beverage - carbonated(?x)$:.
Depending on the problem encountered there is also the possibility of mixing (combining) the two types of strategies, declaring from the beginning of the procedures used specific rules some for advance links, some for later links.

The advanced chain rules are applicable every time an intermediate target is reached by chaining back, the results thus generated are immediately recorded in a database structure, thus becoming useful for a particularly flexible and rapid verification of all intermediate targets through the specificity of the approach of the back links.
Business goals, both the final and intermediate ones, can be approached through a multitude of disjoint rules, which involves a phenomenon of knowing and analyzing each separate rule, specialized algorithms and procedures are developed for each type of approach.
We introduce a new concept, the one of Meta-Rules, for certain types of expert systems, they guide the scientific research that is subsequently transposed operationally to particular rules, exemplifying for an expert system applicable to the operational-strategic economic models.,
$If\ the\ ultimate\ goal\ is\ to\ maximize\ sales, try\ to\ use\ the\ rules,$
$11, 28, 44 \ldots, don't\ try\ the\ rules\ 9, 61, 201$
We note the existence of three functional characteristics of the expert systems used to serve the organizational management decision, as follows:

(i) The user's query facility, when the amount of available information is identified as insufficient to solve the challenge;
(ii) The ease of providing explanations that are the basis of the reasoning that lead to a certain conclusion, hub for the subsequent managerial decision;
(iii)The identification within or of the algorithms, procedures, mechanisms that identifies, treats the information with a variable degree of uncertainty;

These functional characteristics allow the development of a type of operation of the system that turns into one of the most powerful tools in the service of the top decision management, for the elaboration of a decision process that has to respond, quickly, flexible and effective to a certain type of concrete challenge.

## 7. PARTICULARITIES OF THE CONCEPT OF INFERENCE IN THE BUSINESS MODELS

In the operational transposition of the concept derived from Artificial Intelligence for different business models, the inference knows some specific particle modifications to them.
In conclusion, the purpose of a business mechanism is sometimes conditioned by the truth value of a proposition, false or true (Falting & Schumacher, 2017).
We identify a specific rule for expert systems, for economic applications, as well:
$quantity - mica \wedge \rightarrow border \Rightarrow duty - free$
In the mathematical logic formulations, Horn Clause is a logical construction that represents a structural rule, which provides a facility for transposition into a logical programming entity, software later, a formal specification process and model theory.
This rule is not the Horn Clause because the logical equivalent contains more than one positive sentence:

$$\rightarrow quantity - small \vee border \vee duty - free$$

It is possible to improve the processing of the business model by the rules of expert systems, introducing a non-border sentence that is true exactly when the border one is false, a primary test shows that this is impossible to happen, the necessary conditions can be closed by any kind of inference.
It is necessary to introduce a new type of concept, negation as failure, the formal structure for this principle is if the inference engine cannot prove, *then it must be assumed that* $\rightarrow p\ is\ true$.
This rule of approach is correct under the assumption that a complete inference procedure guarantees that the inference engine allows to demonstrate $p$.
For the specific issues of the different business models, we identify a new type of challenge, the lack of a means of knowing a proof of confirmation of a hypothesis p, we can position ourselves on

the thinking trend which states that the procedure used does not find any inference, the challenge remains open if $\neg p => q, \neg q => p$.
If the first approach rule, previously stated, is used, the second thinking hypothesis will never be used, so there is the relation ¬p and q, conversely, if the process approach is made through the second thinking hypothesis, we reach the conclusion p and ¬q, exactly the opposite of the first case approach.
This study for the phenomena with an increasing degree of complexity, the situation of the organizational business models, used in the modern economic environment, are a consequence of the fact that the logical negation introduces a non-monotonous character of the process, which appears in the thinking classical logic.
Passing from $TRUE$ to $FALSE$ is perfectly possible for a sentence.

## 8. PARTICULARITES OF THE APPLICATION OF INFERENCE IN BUSINESS MODELS

The transposition into operation of the rules of inference makes the set of sentences considered true to continuously present a monotonous increase.
We can thus appreciate that we have to deal with *Monotonous Logic Phenomena.*
Since top decision management is ultimately coordinated by a human individual, it is well known that human thinking is a Non Monotonous Process, (Falting & Schumacher, 2017), the inferences that have emerged are often revised when additional information and data becomes accessible to the human decision maker.
As an example, Johny is an end customer, the conclusion that consumption (Johny) seems well founded, but when additional information appears that Johny is a child, the problem becomes the rule:

$$consumer => sweets$$
$$consumer \wedge \neg Johny \wedge \neg sweets \wedge \ldots => consum$$

Such rules are only applicable if a large number of facts are known, their use in a specific business operation is therefore quite difficult to do.
An effective formulation is possible using the Logic of Defects (Errors), where the rules for the business issues addressed include negative conditions, thus

$$consumer \wedge \neg abnormal => sweets$$

the inference is the same as in the absence of explicit knowledge of the negative conditions.
If the human decision-maker identifies that such a condition is not possible to be satisfied, the inference system overrides the conclusion, all the consequences are also maintained so that the developed rationale remains operational and up-to-date.
The automation of such treatment requires the introduction of a concept of greater magnitude and complexity as well $Reason\ Maintenance\ Systems.$
This is an approach for knowledge representation, it manages extremely efficiently the deduced information that is subsequently explicitly stored.
The initial assumption for the business models is that all the economic acts within an economic organization have the same degree of importance, then a distinction is made between the fundamental commercial acts that are solved and those derived from them following strategic operational processes.
The coherence maintenance system is the one that develops specialized technologies for the operational implementation of solving the problems that require the elaboration of a managerial decision of a certain application level, entry, middle, top.
We identify for the modern economic problem, the fact that these techniques share a common architecture, structured on two components, a motivator and a system of permanent maintenance of

the rations, the communication between them is ensured by an interface that has a high degree of flexibility.
The maintenance system justifies its existence by recording the inferences and arguments of their existence, at the same time the motivator informs in a continuous flow the maintenance system which are the economic acts-facts with a degree of truth valid at each moment.
The truth value of the derived economic facts are stored in order to maintain a certain minimum level of awareness if an inconsistency is derived.
The level of truthfulness is maintained using a *TMS* system.
This is a special software for automating some parts of the human language translation process, it includes two types of technology, managing the processes of automating the effective workflow and the language technology adapted to the type of business model implemented for each economic organization.
Systems of this type frequently manage the operational aspect of business models, improving their performance.
At the same time, through processes of representing the knowledge and their underlying dependencies, we identify an algorithm for verifying and maintaining a certain level of truth (certainty), the ability of these systems to restore consistently is the main argument in maintaining a certain mandatory level of truth.
A process of permanent review between old knowledge (data) whose truth value is confirmed and current knowledge, located in a knowledge-base is developed with the help of these facilities.
In case of the occurrence of certain contradictions between the knowledge (data) present, the update and the form of data storage, bases or deposits are required (Faltings & Schumacher, 2017).
Use of specific facilities T.M.S. follows the contradictory data with the help of dependency records, these explicitly reflect the extractions and introductions that have as a direct consequence that the inference engine has a minimum level of confirmed economic truths.
Mathematically, the T.M.S. can be represented in the form of graphs, the nodes in the network are the entries in the databases, the arcs representing the inference stages through which the node is derived.
In all cases of deductive fundamental classical logic, the number of deduced facts increases continuously in a monotonous manner.
The studied process is one of Monotonous Inferences; otherwise, the inference engines that allow the retraction of economic facts stored in databases or data warehouses are called Non-Monotonous Inferences.

## 9. PARTICULARITIES FOR THE BUSINESS MODELS OF COHERENCE MAINTENANCE SYSTEMS

It should be mentioned, (Sowa, 1983), as a first observation, that a system for maintaining coherence has two very important characteristics:

(i) presentation of activities (facts) typical of business models, which offers the possibility of expressing the level of uncertainty vis-à-vis the validity of a proposal;
(ii) to carry out a continuous process of elimination and addition of statements stored in databases or data warehouses, it is permanently followed to maintain a level imposed by the consistency of the whole.

The structural-functional form of a "coherence maintenance system" S.M.C., agreed by the business models is that in which each sentence becomes a node, which represents an explicit state of the model, which has the credibility of the IN or OUT form; for the IN form it means that the inference engine demonstrates the logical proposition to which the reference is made, it becomes a premise or consequence of another premise (Falting & Schumacher, 2017).

The OUT form demonstrates that the inference engine does not have clear information about the veracity of the sentence analyzed, the activity of the coherence maintenance system has a differentiated structure according to the nature of the node it treats, operationally it has the type of type:

$(0)(OUT\ n),(OUT(NOT\ n)):the\ system\ knows\ nothing\ about\ the\ truthfulness\ of\ n$

$(0)(IN\ n),(OUT\ (NOT\ n)):the\ system\ consieres\ n\ true$

$(0)(OUT\ n),(IN\ (NOT\ n)):the\ system\ consieres\ n\ false$

$(0)(IN\ n),(IN\ (NOT\ n)):contradictie$

In their structuring mode, each node in a S.M.C. contains justifications of the economic operations, which show the trends of the totality of the inferences through which the respective node was reached, these justifications contain in structural or:

(i) The rule that gives the sentence associated with the node as a conclusion;
(ii) The nodes that have been used to satisfy the conditions imposed by the rule;

We identify the possibility of developing a process that improves the effectiveness of the previous treatment for organizational business models.

If the representation of nodes within the process is done in a manner, $(In/OUT < proposition > < reasoning >)$.

Applying this type of reasoning in a specific application for marketing, as a rule, $CLIENT - CONSUMER$, we have the structure:

$(IN\ client\ (?x)?j1)\wedge(OUT\ abnormal(?x?j2 =>$

$(IN\ consume(?x)(THE\ CLIENT\ CONSUMES?j1(OUT?j2)))$

If *A*, *B* are the justifications of the two imposed conditions,

$(THE\ CLIENT\ CONSUMES\ A\ (OUT\ B))$ .

This is the justification of the conclusion reached with the logical application of the rule as sustainability.

## 10. OPERATIONAL - STRATEGIC ALGORITHMS FOR BUSINESS MODELS

For the issue of business models we consider that they have a significant degree of relevance "*Addition and withdrawal algorithms*".

Consistency maintenance systems are strongly correlated with the inference engines, thus, all the sentences with a certain truth value, the identities within a data warehouse are operated using a S.M.C. appealable for two functionalities, as follows:

(i) if a sentence is deduced using the inference engine, then S.M.C. must add it as a node in the afferent data warehouse if it does not exist, it must be placed in the IN node and then installed with the explanation corresponding to the new thinking path;
(ii) if a contradiction is identified and an economic fact is desired, the corresponding node must be placed in the OUT;

In the following we present the form of a coherence maintenance algorithm adapted for operation of the business models, (Falting & Schumacher, 2017), with effects on the databases and data warehouses used by the top organizational decision-makers:

(i) if the existence of a node is confirmed for a sentence, the new justification is added, otherwise the creation of a new node N to which the justification is associated is obligatory, the state of the node is positioned IN or OUT, according to the assertion made;
(ii) a list L is drawn up in which all the consequences from $N$;

(iii) for all the nodes in the list, the justifications are subjected to a re-evaluation process, so it is verified that there is a validity independent of N, if they are totally invalidated, the node is positioned in OUT and the coherence maintenance procedure is apical; conversely, if a validity justification exists, the new one is marked with an IN, in this case the re-evaluation justifies all the consequences, they can thus become valid;

(iv) we control if there is a contradiction, if a node allows deduction, a NOGOOD node then is a contradiction, the system detects contradictions until a node of the NOGOOD type becomes an IN, which represents the signal for the inference motor that holds the output nodes and gives them a OUT type state.

## 11. ANALYSIS OF THE ADDITION/EXTRACTION ALGORITHM

A detailed analysis of the algorithm presented above reveals that a main characteristic of propagating the change of the state of a node with the corresponding consequences, for the maintenance algorithm of the coherence, (Russell & Norvig, 2003), each node is the product of a different derivation die, this involves generating a process of re-evaluating the justifications for verifying their truth value.

A very important aspect is the evaluation of the cost of the propagation process, if there is a possibility that a node in the presented algorithm will induce a significant number of consequences.

Thus, for certain business process specific features, it is advisable that coherence maintenance systems be implemented and used with supplementary assessments.

During the operation, if contradictions are identified, it becomes very useful for them to be memorized, the deductions that generated them can be avoided later, this condition is easily achievable by explicitly marking the contradictory nodes as *NOGOOD*.

The classical perception for *NOGOOD* is a strong logical contradiction, as for example (P and ¬P), in certain point cases it is particularly useful to introduce another type of contradiction, if a variable x has only a unique value, a contradiction is deductible starting from $(x = a, x = b \; si \; a <> b).$

When a contradiction occurs within a rationing of the type used in the elaboration of the top managerial decision, this has the consequence that the conflicting value must be withdrawn.

For the systems used in the economic applications there are no general rules that allow the elaboration of a decision which values must be withdrawn, the choice is delegated to the inference engine that applies a heuristic type paradigm to solve this type of task (Kowalski, 1979).

The coherence maintenance systems allow the introduction of hypotheses to develop arguments with a higher degree of generalization, for example they are particularly useful in the demonstration of the transitivity with the implication rule, as follows:

$(i) A => B (assumption)$
$(ii) B => C (assumption)$
$(iii) A (assumption)$
$(iv) B (modus\ ponens\ (i)(iii)$
$(v) C\big(modus\ ponens\ (ii)(iv)\big)$
$(vi) A => C\ conditional\ evidence\ (v)(iii)(i)(ii)$

Where modus ponens is a rule of inference, in which "P => Q, true, so true Q"; a general strategy for identifying the conditioned evidence implies an explicit, clear rule, for deducting the transitivity, we also assert that an analogous process is possible to be operational, even though the derivatives operated are much more complex.

## 12. CONCLUDING REMARKS

Like inference engines, the "tools" specific to expert systems are increasingly integrated into the intelligent systems specific to modern business models, top technological economic organizations within *the Cognitive Computing departments*, integrates expert systems in combination with other information technologies, as well *Analysis and Understanding of Human Language* and *The Skills of Knowledge*, in parallel, accelerated development is known by numerous systems for solving the challenges of online business models (Falting & Schumacher, 2017).
Innovative concepts like Business Rules know other dimensions and offer new perspectives, being approached through expert systems.

## REFERENCES

Baader, F., Calvanese, D., McGuinness, D.L., Nardi, D., Patel-Schneider, P.F. (2003). *The Description Logic Handbook:Theory, Implementation, Applications*. Cambridge, U.K: Cambridge University Press.

Dechter, R. (2003). *Constraint Processing.* San Francisco: Morgan Kaufmann Publisher.

Faltings, B. & Schumacher, M. (2017). *L'intelligence artificielle par la pratique* (2e edition entierement revue). Presse Polytechniques et Universitaires Romandes.

Kowalski, R. (1979). *Logic for Problem Solving*, Elsevier North Holland.

Murphy, K.P. (2012). *Machine Learning:A probabilistic Perspective*. Massachusetts London, England: The MIT Press Cambridge.

Pearl, J. (2009). *Causality: Models, Reasoning and Inference*. Cambridge University Press.

Rossi, F., van Beek, P. & Walsh, T. (2006). *Handbook of Constraint Programming.* New York, NY, USA: Elsevier Science Inc., ISBN 9780080463803.

Russell, S., & Norvig, P. (2003). *Artificial Intellicence: A Modern Approach* (2nd Edition). Prentice Hall.

Sowa, J. (1983). *Conceptual Structures: Information Processing in Mind and Machine*. Ed. Addison-Wesley.