A MULTI-PARDIGM APPROACH FOR SOA GOVERNANCE IN IT COMPANIES

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Abstract

Service Oriented Architecture and cloud computing provides the IT infrastructure, design patterns and other artifacts to an IT company get interoperability between software programs. A SOA Governance problem refers to the coordination of people, processes and technologies involved in each area within an organization. It mean planning under uncertainty and considering risks once it aims to make processes more efficient, reduce redundancy and optimize them in order to improve supervision and giving better decision-making processes. By evolving the policies that guide decision making, there are emergencies, feedback control mechanisms and many events that must be considered in order to better comprehend the complexities in the real world and the factors that could influence a problem that must be faced. Agent based modeling, system dynamics modeling and event based modeling are discussed and exemplified as three methods that could be used as a way to give to managers and technical staff flight simulators that could aid them to cope with governance complexity and comprehend how a policy change will affect their SOA Governance system.

KEY WORDS: *System Dynamics, Competitive Intelligence, Strategic Planning Product Project; Relevant information, SOA governance, cloud computing*

I. INTRODUCTION

SOA Governance (SG) problem refers to the coordination of people, processes and technologies involved in each area within an organization to estimate problems that comes from subjective variables like credibility over time. It means planning under uncertainty and considering operational and even image risks once its goal is to make processes more efficient, to reduce redundancy and to optimize them in order to improve supervision for the creation and evolution of IT assets and resources.

Planning under uncertainty and considering operational risks inherent of IT enterprises requires reliable tools to do better analysis and to manage IT assets in order to set policies that assure good performance and credibility to such organization.

Thus, combining SD method to agent-based modeling and event based modeling (Fig.1), a three decision making simulation methods, applies dynamic business simulation to cope some aspects of the social-economic and political environment under an IT organizational perspective via computer simulations before managers interfere in the reality. The primary gain is a better planning process that benefits from simulation before making a decision and thus moving energy and resources to achieve the goals.

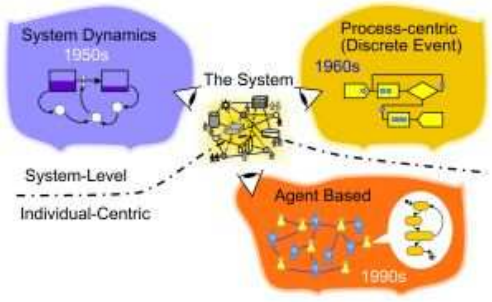

Figure1: Multimethod simulation approach [1]

To place the issues into perspective, this paper has four sections. First, it observes a little literature review of the three simulation methods. Next, discusses ways to model SOA governance by the combination of three methods. Follows considerations on modeling SOA governance in IT companies. Finally, in the conclusion, there are considerations regarding the use of a multi-paradigm approach to address SOA Governance typical problems

II Literature review

Modeling is based on abstraction, simplification, quantification, and analysis [1]. The modeling process is an iterative learning process that encompass many steps like getting information about the real world or the problem articulation, structure a dynamic hypothesis, formulation or transformation of the dynamic hypothesis in many diagrams, testing and the policy formulation and evaluation [12] to assure that “the model’s structure is sound and that it is capable of reproducing the dynamic symptons of the original problem” [11]

IT organizations are complex systems so interactions among many components may cause relevant differences in system’s performance. When a study domain is quite complex, approaches based on equations or on other analytical techniques are impracticable or even impossible to be applied. [5]

System Dynamics (SD) method was proposed by [7] that observes that once a decision is based on the observed state of the system, there are a structure of interacting feedback loops and it implies a circularity of cause and effect, where the system produces the decision which produces the action which produces change in the system. Within the feedback loop there are level variables that mean accumulations within the system and mathematically are integrations. Rates variables that are system condition at any point of time represent the system activity and are the policy statements in, the system which defines how the existing conditions of the system produce a decision stream controlling action. Rates are not instantaneously observable once they depend

only on the values of the level. Rate equation defining a rate variable is a statement of system policy that describes how and why decisions are made. “A policy statement incorporates four components - the goal of the decision point, the observed conditions as a basis for decision, the discrepancy between goal and observed conditions, and the desired action based on the discrepancy” [7].To know more details about the methodology, see [7].

Agent based modeling (ABM) method try to relate the heterogeneous behavior of the agents (different information, different decision rules, and different situations) with the macro behavior of the system [9], [4]. The agents have several interaction rules and, by simulation, it is possible to explore the emergent behavior along the time and the space [2], [3]. This modeling technique does not assume a unique component that takes decisions for the system as a whole. Agents are independent entities that establish their own goals and have rules for the decision making process and for the interactions with other agents. The agents’ rules can be sufficiently simple, but the behavior of the system can become extremely complex .To use agent based modeling, the first stage is the definition of the rules to model agents’ behavior. The criteria that can be used to the rules delimitation is based on the variables used in the dynamic model and the agent-based model.

The event based modeling (EBM) is a kind of discrete event modeling that considers that “processes we observe in the world consist of continuous changes” and that the technique “approximate continuous real-world processes with non-continuous events that you define” [1]

The term Discrete Event is however mainly used in the narrower sense to denote "Process-Centric" modeling that suggests representing the system being analyzed as a sequence of operations being performed on entities (transactions) of certain types such as customers, documents, parts, data packets, vehicles, or phone calls. The entities are passive, but can have attributes that affect the way they are handled or may change as the entity flows through the process. Process-centric modeling is a medium-low abstraction level modeling approach. Although each object is modeled individually as an entity, typically the modeler ignores many “physical level” details, such as exact geometry, accelerations, and decelerations. Process-centric modeling is used widely in the manufacturing, logistics, and healthcare fields [1].

In order to cope with the complexities and peculiarities of IT organizations and to get a better SOA governance, the authors considered the use of these three methods combined. Agent based modeling is better when there are individual data available, SD when you have information about global dependencies, and EBM if the system can be easily described as a process[1]. The authors believe that these techniques are most useful particularly for organizations that are certified at level four or five of the Capability Maturity Model Integration (CMMi) Model.

III SOA Governance modeling

There are seven strategic goals of service oriented computing for the long term benefit of an IT company[6]: increase intrinsic interoperability, increase federation, increase business and technology alignment, increase vendor diversification options, increase return over investment (ROI), increase organizational agility and reduce IT Burden.

The movement to cloud computing is the disruptive change that IT departments will soon face as service oriented architecture (SOA) and cloud computing begin to have an effect on the modern enterprise [10].

A SOA Governance system places constraints on decisions; determines who has responsibility and authority to make decisions; establishes constraints and parameters that control, guide, or influence decisions; and, prescribes consequences for non-compliance. In discussing the differences between management and governance states that "management is a system and resources that are responsible for day-to-day operations" while "a governance system establishes rules and constraints" or, at a final conclusion, it could mean the ability of doing applied policies[6]. To the author, "an organization establishes governance to mitigate risk and to help advance its strategy, goals, and priorities".

SOA Governance is a multifactor approach and SD combined to ABM and EBM gives the capability to better manage risks factors to help managers to better know the productivity, the comprehension of business growth (revenues), the results of marketing campaigns (credibility) and the wealth of the company so they can identify and analyze trends. A stochastic programming model for a SOA Governance is dynamic since the information on the actual value of uncertain parameters is revealed in stages.

IV Modeling SOA Governance on IT Companies

The preceding concepts will be exemplified in order to show their utility and how it can be used by a SOA governance research. As it is about interactions within the company, within the market, and between the two, in this paper, a model with no influences of the outside can be made by system dynamics modeling, market dynamics can be understood by an agent based model, processes analysis can be done by event based modeling in order to represent their behavior, the social-economic and political environment to provide deeper insights by simulation experiments and the flows of goods, services, money and information.

A. SD Approach

System Dynamics modeling gives a way to address SOA governance problems for IT organizations and to explain phenomena and the structure of the system via stock and flow representation and the causation between factors. Fig.2 shows the rich picture of a SOA governance problem:

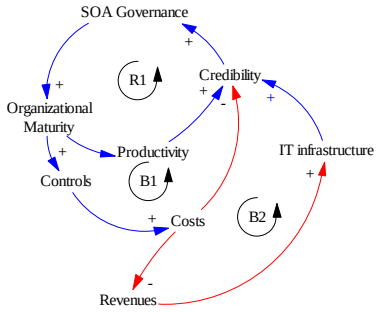

Figure 2: Cause and effects on factors for a SOA Governance Model

In Fig.2, the performance of a SOA governance (SG) program increases the organizational maturity, which increases productivity, which increases credibility which causes better results in terms of SG. Organizational maturity also increases controls that could decrease credibility and thus reducing SG initiatives. Less revenues means less investments in IT infrastructure that could affect credibility of the company. Productivity, costs and "IT infrastructure" are factors to be managed in order to get a good credibility. They can influence the establishment of good practices for better SOA governance and managers must decide what to do

in order to maintain it in adequate levels and thus get more credibility. SD, ABM and EBM simulation can help them with tools that implement management flight simulators [12]. Also is useful to develop an organizational maturity model and a dynamic scorecard model in order to know the actual stage of the organization in terms of their SOA program and to get better management strategies.

Thus, Fig.3 shows a simplified SOA governance model that puts together the capacity dynamics, the revenue process and their interaction to infrastructure all of them accumulating a backlog of agnostic and non-agnostic services that requires the capacity to adjust to the services consumption. More than the model presented in Fig.3, the full model contemplates the delivery delay, production dynamics and capacity adjustment that could not be shown in this paper.

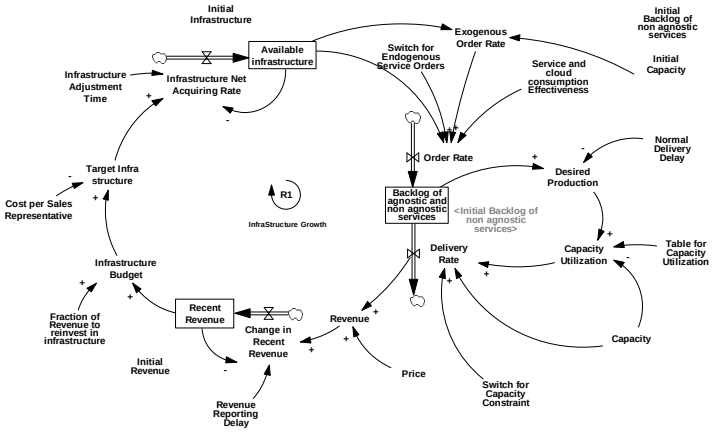

Fig.3: A SOA governance model

Fig.3 diagram explain in more details how policies can be quantitatively observed even though some variables are qualitative by nature. Based on the dynamics of a particular IT company under research, some examples of policies were implemented in the model as:

- A one quarter-year delay is assumed in the budgeting process;
- Twenty percent of the organization's budget is allocated to the infrastructure;
- The fully loaded cost per infrastructure representative is $8000/month;
- An average delay of 18 months is required to adjust the infrastructure to target levels;
- Capacity utilization saturates 25% above normal, implying normal utilization yields 80% of maximum output (Fig.4).

After a simulation experiment graphic in Fig.4 was produced showing that the system that was in equilibrium alters its structure after some policies were changed, giving another behavior.

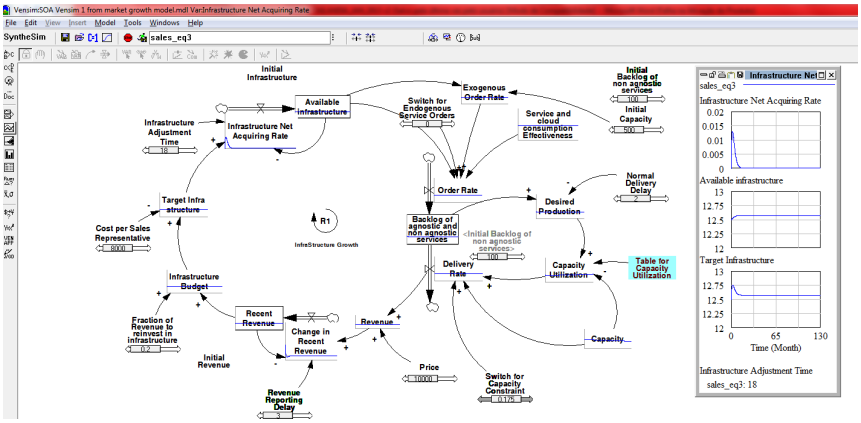

Fig.4: A SD simulation experiment

Risk management in an IT organization is a decision problem. As in economics an external factor like interest rates can give insights over the decisions and to comprehend the behavior of the system over a fixed value or by a probability distribution that could explain it. SD was useful once the model was built up of probability distributions and rely to some degree on obeying important probability and statistical rules.

B. Agent based simulation and Event based simulation

Fig.5 presents a conceptual model to study IT organizations governance.

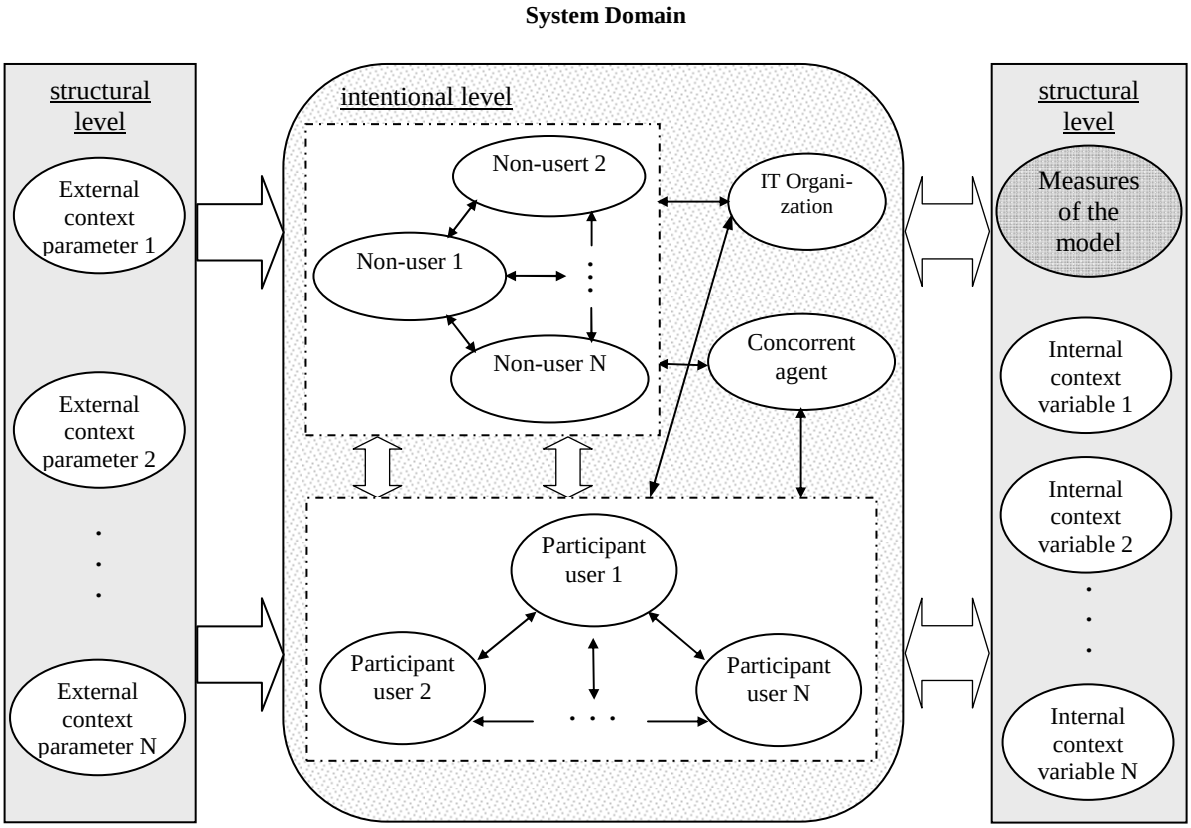

Fig.5 – Generic conceptual model to study IT organizations governance by an Agent based modeling method [13]

This model was originally developed for regulatory governance analysis of sectors under regulation [13]. The conceptual model is generic and, consequently, it is useful to structure different IT organizational scenarios. The intentional level (action level), where the interactions among the agents occur, is differentiated from the structural or contextual level. The structural level indicates the contexts where the interactions happen, e.g., the circumstances that limit, amplify and determine the interactions among the agents and with the environment. Moreover, structural level is the level where the emergent phenomenon takes place. It is a higher level comparing to the intentional level where the agents interact. The basic principle that guides the model is that all interactions have an intention or a set of intentions[13].

Many organizational process are internal and there are few that involves managing the relationship with clients of an organization. In order to illustrate an agent based simulation combined to an event based simulation, a very simplified call center process will be considered. The authors adapted an [1] simulation model to study a contact center process behavior considering that there were two "types" of calls arriving at a contact center.

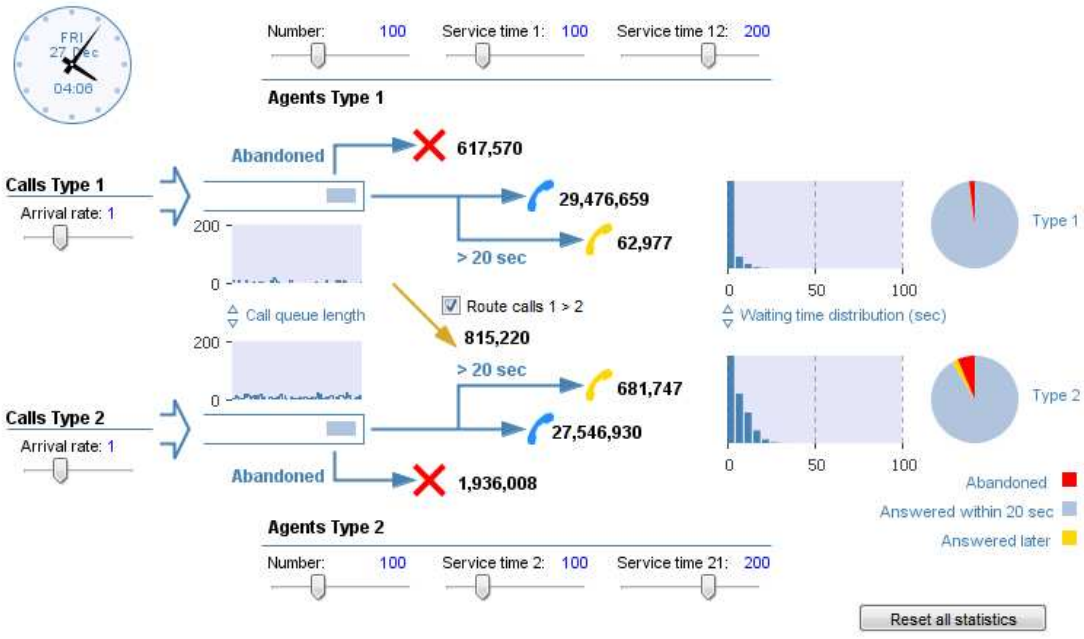

Fig.6: an event based simulation combined to and agent based simulation [1]

The arrivals follow a poisson distribution with two known arrival rates. The simulation considered that there was a queue for each call type and some callers abandon from the queue after a certain time according to an exponential distribution with mean calculated from real experiments by using statistics methods. There are 2 agent groups, one trained to handle calls of type 1 with a known mean service time and group 2 is trained to handle calls of type 2 with a knowable mean. However the agents are also cross-trained such that group 1 agents can handle type 2 calls with a mean service obtained from the reality Typically the cross-trained agents will have lower performance with their non-favorite skill. The logic for routing the calls can take various forms. In this implementation when the call is processed it is routed to the "native" agent, if there is one available, otherwise, the call is routed to the "alien" agent, again if the latter is idle.The output metrics in this model are

the queue lengths and "service levels" for both call types. By service level we mean the percent of incoming calls answered by an agent within 20 seconds.After simulating for a while, results on Fig.7 is considering the logic of the business process and the factors.

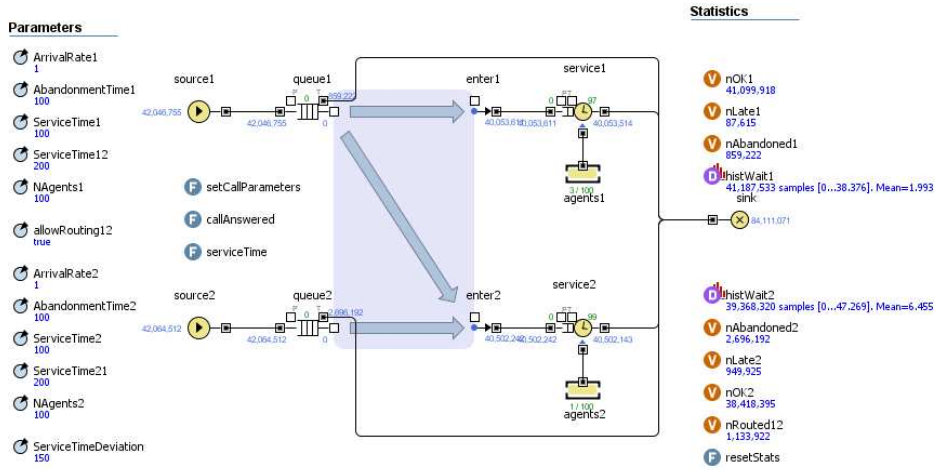

Fig.7: a simulation experiment of ABM and EBS [1]

V Conclusions

The research is multidisciplinary and interdisciplinary by nature and the article presents part of the literature review and methodological strategy to develop the research. The multi-paradigm approach is suitable to model subjective factors to simulate the complexity of IT organizations systems considering their risks and uncertainties in a SOA Governance program.

The modeling process of an agent-based model defines its individual components, as a bottom-up approach. The definition of the agents' behaviors is extremely important for a good representation of a SOA-Governance model. Besides, there must be a very good equivalence between the system under analysis and the conceptual model to guarantee great consistency to the agent-based model and reliability from the simulation results[8].

Once credibility is being modeled, population dynamics and client satisfaction studies focus on the population dynamics of an IT organizations that has, among others, rates of complaint, satisfaction and efficiency that must be considered in assessing credibility and estimating opportunities to optimize business process in order to forecast productivity enhancement opportunities quantitatively.

This way, the research is being conducted by the authors and it combines methods and techniques to study IT organizations models and the influence of subjective factors over it. It is projected to combine structural model and internal model to better mimic the real system.

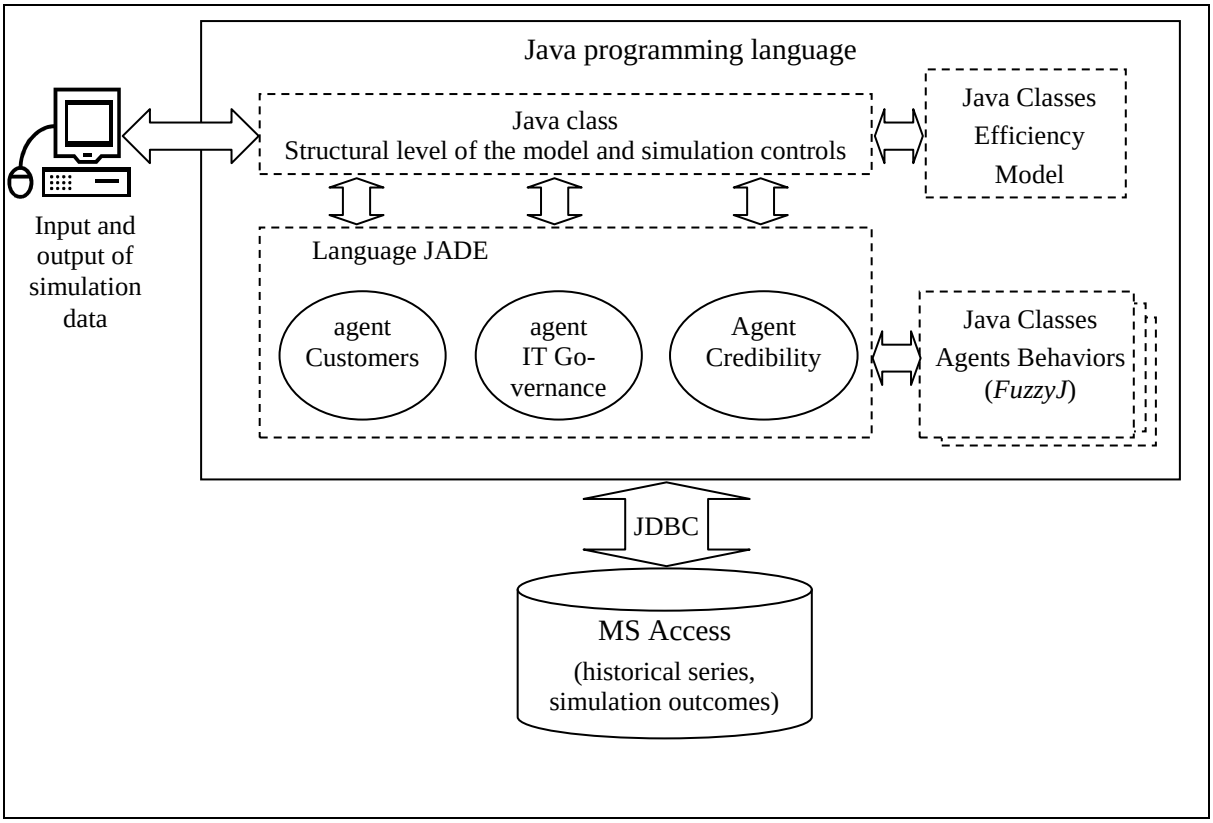

Fig.8: The combination os many approaches in order to develop a SOA-Governance Information System

The research is in progress and Fig.8 shows the software planned to be developed in order to combine these methods and to get a multi-paradigm approach on modeling credibility, including a fuzzy logic engine in order to better manage risks and uncertainties over the mapping of probabilities and creating different combinations of logic that can be applied to the model.

The authors identified the main actors and the methodology to proceed the modeling recommendations identified on the literature review. The software to be produced will consider efficiency, effectiveness, credibility and productivity based on operational and image risks and compliance to help Brazilian IT companies on anticipating problems, better produce policies and determine the growth and stability of the enterprise by comprehending how a policy change will affect the total system.

It's also possible to say that, before starting a software engineering development project by defining functional requirements and structuring use cases, these techniques are useful to model the behavior or processes and comprehend how distinct functions can interact with each other. Thus, the non-functional requirements could be better elicited once it engineers the system as a whole using systems principles.

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