

INTRODUCING INTELLIGENT AGENTS TO OUTSOURCING

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Abstract: In the last few years, agent technology has significantly emerged as a new paradigm for software developers to solve complex problems. This paper extends the use of multi-agent systems into a new domain of outsourcing. It highlights the various issues associated with outsourcing decision making i.e. the complexity and the risks involved in outsourcing. The paper outlines the HABIO framework which proposes a tri-perspective approach focusing on the organisational, information and business perspective to facilitate the outsourcing decision-making and formulating an effective outsourcing strategy. The main focus of this paper is to describe how agents can assist the experts in their decision to support outsourcing. A call-centre scenario illustrating a 3-layered agent architecture is proposed which aims to capture the strategic, tactical, and communicational layers of outsourcing and supports the experts in their outsourcing decision-making.

1 INTRODUCTION

Outsourcing is one of the most prevalent trends in the IT industry today. It accounts for nearly over 35% (i.e. a third) of the IT and Consulting Services market worldwide (Andersen, 2004). In the last decade, companies are focusing on what is deemed as the best/smart/right-sourcing of various business functions rather than the complete Outsourcing of IT operations which was initiated in the late 1980s by Kodak Eastman (Loh and Venkatraman, 1992).

There are various definitions of “outsourcing” such as “procuring of services or products from an outside supplier or manufacturer in order to cut cost”. In business context, it can be defined as the transfer of an internal non-core function of a business organisation to an external vendor. According to Laudon *et al.* (2004) outsourcing can be defined as “the practice of contracting computer centre operations, telecommunications network, or application development to external vendors”. Elliot and Torkko (1996) define outsourcing as “a conscious business decision to move internal work to external suppliers”. Initially motivated by necessity and later a cost-cutting move (as shown in Table 1), outsourcing has now evolved to become a management strategy in various industries mainly in reducing operation costs.

Table 1: Evolution of Outsourcing.

Time	Issue	Forms of Outsourcing
1960s	Cost of mainframes	Time-sharing (e.g. payroll processing)
1970s	Cost of software development	Contract programming
1980s	Plummeting cost of computing capability	Reverting to Insourcing / In-house retention
1989s	Kodak Eastman Mega-deal	Reactionary trigger (sparked bandwagon effect)
1990s	Strategic concerns	Onsite facilities management and Selective Outsourcing
2000s	Transformational concerns	Business Process Outsourcing and Offshore Outsourcing

Although there are several advantages associated with outsourcing (Davidson, 2004; Kruse and Berry, 2004; Namasivayam, 2004; Sloper, 2004), like any other business operation, there is a degree of risk involved, such as the loss of strategic direction and

loss of organisational competencies (Aubert *et al.*, 1998; Earl, 1996). In its 2004 report, the research group Gartner indicated that as many as 80% of outsourcing deals are unsuccessful and that European businesses wasted \$7bn on poorly managed contracts (Glick, 2004). This highlights two main issues - the first being the potential complexity of outsourcing decision-making and the second being the financial risks involved. One risk which companies are increasingly concerned about is the lack of flexibility in long-term contracts. This was highlighted by the collapse of the Royal Bank of Scotland (RBoS) 10 year \$1.3bn mega-deal with IBM, which was indicated to have failed due to its inflexibility to accommodate the business changes following the merge of RBoS with Halifax.

Outsourcing can be seen as a potentially complex decision-making process, which ideally takes into account various degrees of information from a wide range of domains such as technological, economical, geographical and political factors. Decision-makers not only need to critically analyse all aspects of the business, but also need to interact with multiple organisational layers in order to understand the implications and risk associated with outsourcing.

Outsourcing is really a huge domain covering various aspects of a business for example human resource management, administrations, finance, manufacturing, insurance, credit checks, food catering, customer service, etc making it practically impossible to cover all these areas. The focus of this paper is to describe how agents can assist call centre outsourcing and integrate the various kinds of knowledge associated with the decision making in these operations. Due to the myriad of potential risks, coupled with the need to incorporate multiple facets of information, it is anticipated that the use of strategic framework techniques, enhanced by agent technology, will be an increasingly feasible candidate for decision support in the outsourcing decision-making process. The role of the agents would focus on strategic, operational and tactical issues within an organisation taking into account the various facets of outsourcing. These agents will also be managing and monitoring the service level agreements (SLA) and risks at different stages of outsourcing.

2 HABIO FRAMEWORK DEVELOPMENT

Although there have been projects and initiatives associated with Outsourcing, they tend to focus only on specific aspects such as partnerships (Grover *et*

al., 1996), performance (Loh and Venkatraman, 1995) and whether to insource or outsource (Meyer, 1994). There is still a lack of an integrated method which considers the business organisation as a whole in Outsourcing decision-making. An ideal method would gather, model and represent the information in such a way which facilitates both Outsourcing decision-making and the formulation of an effective Outsourcing strategy. In order to facilitate this, the proposed agents will take a Holistic Approach {Business, Information, Organisational} (HABIO) framework (Ho and Atkins, 2005) which addresses issues within multiple domains, such as financial costing, performance benchmarking and degree of union pressure.

Figure 1 illustrates a conceptual model of the HABIO framework. Its development was based on the Information Systems Strategy Triangle (ISST) which is both a well-documented concept and a well-known convention (Frenzel and Frenzel, 2004; Robson, 1997). The framework proposes a tri-perspective approach to Outsourcing decision-making which addresses issues within multiple domains, as follows:

- The **Organisational Perspective** involves the consideration of organisational issues and political influences, such as the degree of pressure from trade unions and internal policies which constrain the scope of decision-making.
- The **Information Perspective** involves the consideration of technical issues, such as quality of service (i.e. fitness for purpose), performance metrics for service benchmarking and availability of required external expertise.
- The **Business Perspective** involves the consideration of business issues, such as the financial costing of tangible (e.g. product delivery) and intangible (e.g. research and development) activities within the organisation.

Akin to the ISST concept, the HABIO framework advocates that the corners of the triangle are interlocking, thus a change in one perspective will require re-evaluation of the other two perspectives, in order for corresponding adjustments to be made. This reflects the complex nature of outsourcing decision-making which involves multiple factors that can influence one another, both in an intra-perspective and inter-perspective manner, as illustrated in Figure 2.

In order to address the complexity from multi-influence and interrelations, it is proposed that a fuzzy logic approach involving multi-agent systems be utilised in the decision-making process.

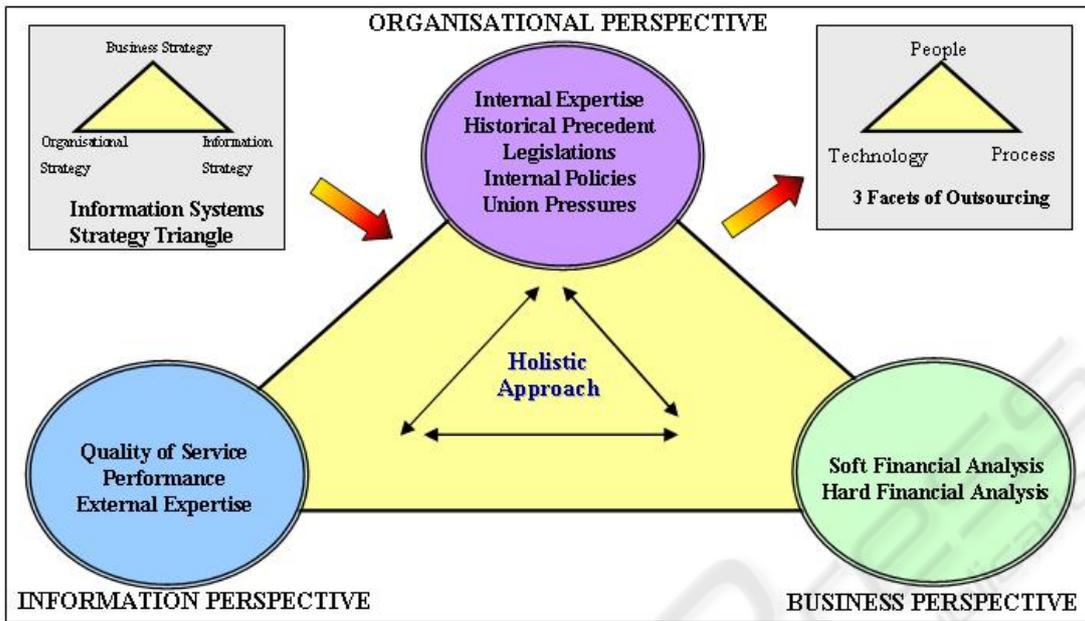


Figure 1: Holistic Approach {Business, Information, Organisational} (HABIO) framework.

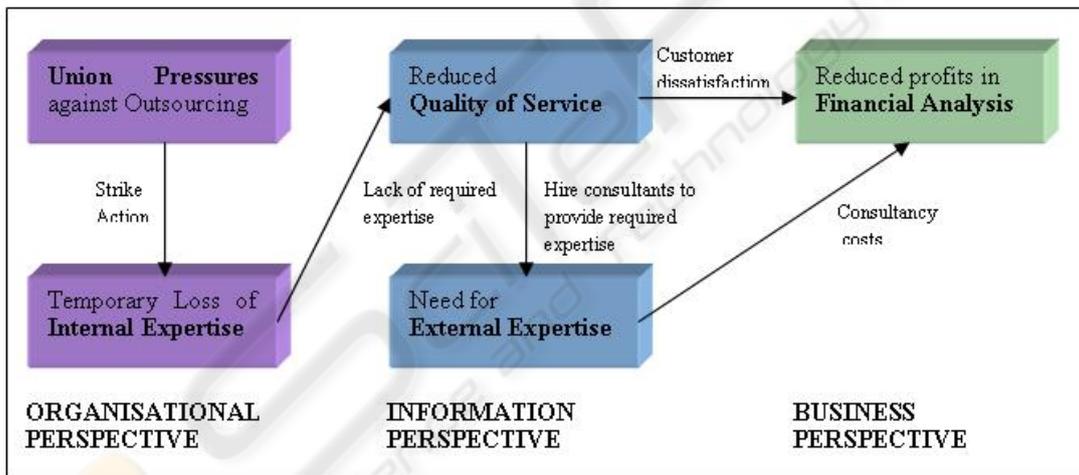


Figure 2: Example scenario of inter-perspective and intra-perspective influences of factors.

3 INTELLIGENT AGENTS

The focus of this research is the use of multi-agent system to assist in the analysis of information collated from the various domains associated with outsourcing and support outsourcing decision-making.

3.1 Agent Definition

There is no universally accepted definition of the term ‘agent’ as it depends on how this agent is used in an application. For some applications, agents can

be defined as computer systems that have the ability to learn from experiences whereas for other applications, learning is not only unimportant but also undesirable (Weiss, 1999). There is indeed an ongoing debate and controversy to define ‘what is’ and ‘what is not’ an agent as currently every system that performs a function is labelled as an ‘agent’. Maes (1995) defines agent as “computational systems that inhabit some complex dynamic environment, sense and act autonomously in this environment, and by doing so realize a set of goals or tasks for which they are designed”. Franklin and Graesser (1996) defines it as “a system situated within and a part of an environment that senses that

environment and acts on it, over time, in pursuit of its own agenda and so as to affect what it senses in the future.” In the simplest term, agent can be defined as a software entity that is capable of carrying out flexible independent activities in an intelligent manner in order to accomplish tasks to meet its design objectives, without direct intervention and guidance of humans or other applications or agents.

3.2 3-Layered Agent Architecture

Though cost is an important viable business strategy to outsource within a call centre, however it is not just about cutting costs but improving the services, focusing on the core components and improving the ability to cope with internal and external demands. The main issues within a call centre include forecasting and scheduling (i.e. predicting the day to day workload and calculating the staffing levels accordingly), and managing the service levels (achieving the targets, for example, answering a certain percentage of call within a certain number of seconds). In order to successfully achieve the set targets, the agents need to extract the right information at the right time from the right experts and present to the right people. In order to effectively assist project managers in outsourcing decision-making, agents need to reflect the various organisational layers (typically as strategic, tactical and operational). Figure 3 proposes a three-layered agent architecture consisting of the strategic, tactical and communicational layers. The strategic layer captures the specific domain knowledge of the project managers by means of ontological representations and identifies the role of each agent. As different agents have different goals, the strategic layer therefore captures the various facets of outsourcing, in particular financial costing (tangible and intangible costs), risk management and benchmarking. The tactical layer is responsible for defining the list of actions for each agent to carry out a particular activity while the communicational layer is responsible for defining messages which would enable exchange of meaningful information between the agents. It is noted that communication cannot be reduced to just the sending and receiving of messages, and thus the communicational layer is also responsible for proper interpretation of the message, i.e. validation and corresponding corrective measures if required.



Figure 3: 3-Layered agent architecture.

4 BENEFITS OF USING AGENTS

Multi-agent systems do not wait for instructions and are capable of reacting to any change in situation without being prompted. Additionally, their agents' domain-specific knowledge is refreshed from ontology without shutting down the system. Thus, agents would be providing their service to the experts 24x7 and assisting them in their decision. Examples of how these agents will be able to assist the experts to achieve the targets are as follows:

- *Cost analysis* – This forms a large part of making an outsourcing decision and needs to be done very thoroughly and carefully. These agents would predict all the various types of costs, direct and indirect, and offer a true comparison to that of the suppliers' costs and therefore estimate the cost advantage that the outsourcing could provide. Agent would also be calculating the cost per call and cost per seat within a call centre which would further help in the outsourcing decision making.
- *Monitoring service levels* – Within a call centre, it is well known that acquiring a new customer is more expensive than maintaining on existing ones. Therefore, maintaining customer satisfaction by achieving good service levels has a significant impact on the organisation's revenues. The agents will be assisting the managers in monitoring the performance and service quality within the organisation for example, some of the performance measurements include number of calls answered, average talk time, abandonment rate etc.
- *Forecasting* – Forecasting within a call centre can be done daily, weekly, monthly, and even yearly. Long term forecasts can be used for budgeting, staff planning, operational changes, training, and scheduling vacations whereas short term forecast such as daily, weekly or every fortnight are needed for call centre workforce staffing and scheduling and to predict the call volumes (Klungle, 1999). Call centres normally

use manual spreadsheets for scheduling the staffs; this approach is usually guesswork at best, based upon the experience of the manager. Under these circumstances it is uncommon for a call centre to be caught flat-footed by demand spikes or to have idle advisors (Robb, 2004). Overstaffing and understaffing can have a huge impact on the business perspective of the call centre. Overstaffing can lead to having idle-advisors which affects the financial side to the business whereas understaffing can create a tension environment as advisors are not able to cope up with the amount of calls. This leads to dissatisfied employees as well as customers. The agents, being highly dynamic and scaleable in nature, would be able to collate and compute the predictions automatically taking into consider the historical data and thus scheduling the advisors by interacting with the various organisational policies.

- *Analysing 'what-if' scenario* – The behaviours of the agents are programmed with rules when put into motion, these agents would provide insights into many different scenarios within the outsourcing domain. As the managers change certain agent characteristics or rules, the corresponding impact can be seen in the model output thus helping the experts to take control of various situations. For example, within the call centres, some of the what-if scenarios that these agents may be used to provide answers are as follows:
 - 'What' happens when there are abnormal call volumes?
 - 'What' would be the total cost of outsourcing?

- 'What' will be the effect on the service level and abandonment rate 'If' it is decided to cross-train some of the advisors to take incoming calls? How much it would have an effect in day to day business cost?

Figure 4 gives an example of the way that the agents would be able to assist the manager in identifying the various risks and factors involved if they plan to outsource. The diagram indicates that the reduction of the organisation's profits depends on the percentage loss of customers, forecasting of the call volume and staffing levels.

5 AGENT MAPPING TO THE HABIO FRAMEWORK

Outsourcing is a very complex decision making process and takes into account the various managerial, economical and technical issues. A wrong decision either at the decision or at implementation level can have devastating effects on an organisation.

In the case of a call centre, four principal factors have been identified, from the literature, as the most relevant factors for outsourcing decision making.

These factors include Cost (i.e. calculation of the total operation costs, cost reduction, etc.), Performance (i.e. breakdown of IT performance, improved service and quality, etc), Quality (i.e. monitoring and improving the quality of service and productivity), and Risks (i.e. identifying and reducing various risk factors with the business domain) (Alner, 2001; Clark *et al.*, 1995, Jurison, 1995; McFarlan and Nolan, 1995).

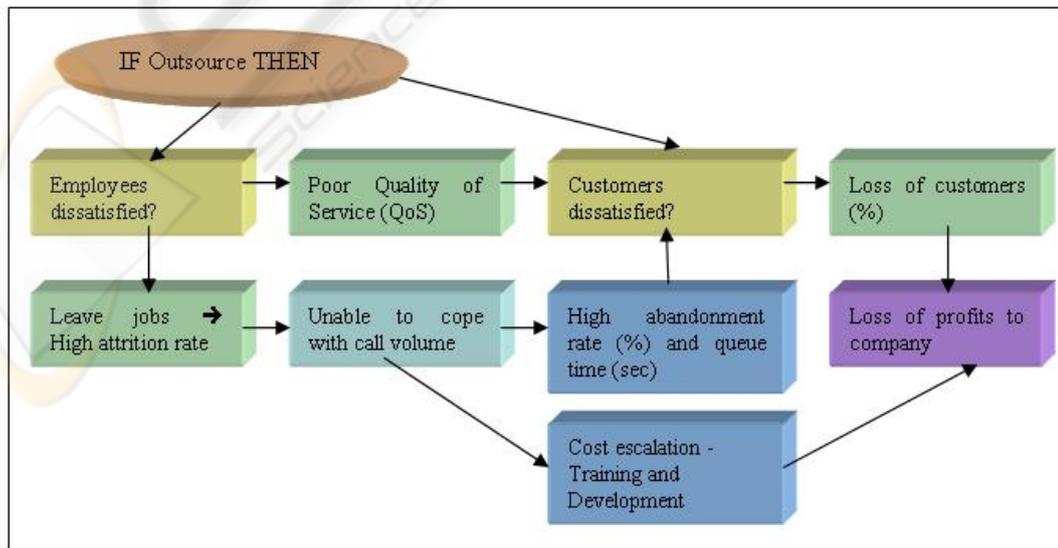


Figure 4: Example scenario of agent-based what-if analysis in identifying the risks factor.

A widely known shortcoming of business applications is the separation of analytical and actionable processes (Politan, 2003). This creates disconnection on both business processes and the technical implementation both of which leads on to various complications of the decision making within an organisation. The agents are used to overcome this inadequacy by its ability to automatically translate the business intelligence into a process on which users/agents can act. Figure 5 and 6 illustrate these factors in a high and low level conceptual model from agent implementation point of view representing various agents acting together in the outsourcing domain. The high level conceptual model, Figure 5, defines the three main facets of outsourcing identified as People, Process and Technology where people involves various experts from which tacit knowledge can be captured by the agents; process includes various activities which the agents would commit to in order to meet its design objectives; and technology defines various tools, protocols and techniques the agents would be using in order to interact effectively and efficiently with various users, hardware and software applications in order to get relevant information about the domain.



Figure 5: The 3 facets of outsourcing.

Figure 6 provides an operational view of the agents as they are identifying the current status of the call centre. As shown in the diagram, Agent A1 is responsible to calculate the organisation's operating cost (tangible, intangible and downtime costs), Agent A2 is responsible for measuring the current performance against the targets (set by the experts), Agent A3 monitors the quality of service provided to the customers, and manages the service levels, and finally Agent A4 identifies the various risks, reports it to the relevant experts and a strategic approach.

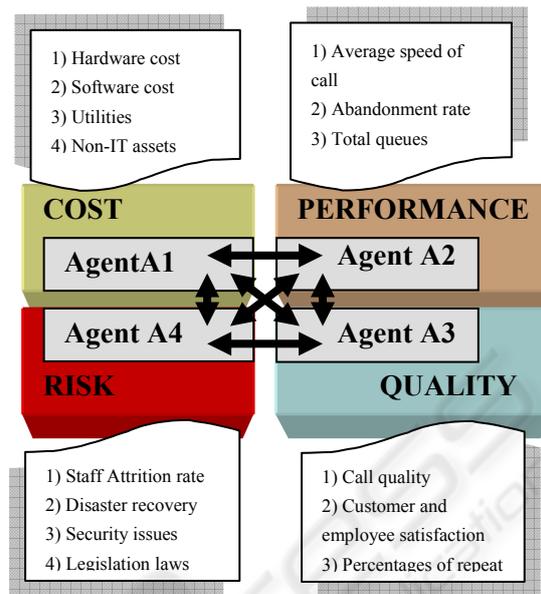


Figure 6: Operational view of call centre agents.

6 CONCLUSION

This paper extended the use of multi-agent systems into new domain of outsourcing for decision-making purposes. In traditional approaches, procedures were manually defined and thus required significant time and human effort. The use of multi-agent systems alleviates this by providing call forecasting, staffing levels, monitoring and managing their performance. This is achieved through the 3-layered approach capturing the strategic, tactical, and communicational layers of outsourcing.

The paper outlined the HABIO framework, which proposes a holistic approach to outsourcing decision-making that emphasises the importance of analysing the organisation as a whole rather than isolated analysis by parts. High and low level conceptual models of the agent implementation were discussed, in the context of a call centre. The various benefits which such agent implementation could provide to call centre operations were also discussed in the paper.

Current research is being carried out to develop an agent-based ontological model to emulate the outsourcing decision-making procedures. This is being done in collaboration with a large retail company which operates several call centres, one of which employs over 1500 call centre advisors.

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