AN AUTOMATED EXECUTIVE AND MANAGERIAL PERFORMANCE MONITORING, MEASUREMENT AND REPORTING SYSTEM:

Mahesh S. Raisinghani
Graduate School of Management
University of Dallas
mraising@gsm.udallas.edu

John H. Nugent,
Graduate School of Management
University of Dallas
jnugen@gsm.udallas.edu

ABSTRACT

This paper puts forward the concept for a new, automated, "management by exception" script-based network tool to monitor, address, and report deviations from corporate plan(s) in near real time via the company's messaging system. In particular, this paper conceptualizes the utilization and application of tools, initially developed for network monitoring and management, in managing and measuring corporate business performance against plan(s). That is, network-type tools (IVAANs™) are used to measure, monitor and report deviations in Key Performance Indicators (KPIs) from plan(s), and accomplish this in a timely, accurate, and automatic manner, without human intervention or filtering.

Senior executives need a sound analytical basis derived from accurate, valid, and timely information for short- and long-term planning and for allocating scarce resources. IVAAN™ notices are directed and delivered to the responsible manager and other parties concerned with the respective KPI via push agents over the company's messaging system. Further, IVAAN™ notices may be accumulated and utilized as an objective measure of managerial and executive performance.

1. Brief Introduction and History of Measurement and Reporting Systems

Since the beginning of commerce, owners and managers have been concerned with measuring performance in order to improve their return on investment and gain competitive advantage. In the late 1800s and early 1900s, Fredrick Taylor, the "Father of Scientific Management," led the way in establishing metrics in order to determine "a better way of doing things". Taylor's methodologies led to a system of job quotas and pay for performance initiatives. In later years the concept of "Short Interval Scheduling" (SIS) was developed and applied widely in the 1960s and 1970s. SIS involved the improvement of on-time performance in process oriented, repetitive type tasks. Employees often saw SIS consultants as tools of management to get them to do more with less. Clearly, these early metrics were a means of measuring the efficiency of non-managerial workers. At this same time, measurements for executives and managers were often lacking, were non-quantitative, or were very high level only.

In more recent times, reengineering, business process management, executive tools such as the "digital dashboard*" and the "cockpit chart" and methodologies such as the "balanced scorecard" have become the mantra of corporate management, in an attempt to not only improve and measure the efficiency of the entity in order to gain competitive advantage, but also to implement systems to better assist and measure more objectively and quantitatively the performance of highly compensated executives and managers as well as non-managerial employees [Hammer and Campy, 1993; Kaplan and Norton, 1998].

Footnote* The Digital Dashboard, a new entry in Microsoft's knowledge management portfolio, is a dynamic web page that runs inside the Microsoft Outlook client. As a corporate portal it can provide connections to documents within the productivity applications in the Microsoft Office suite, as well as to information housed within Microsoft Exchange, Microsoft SQL Server (which now includes an online analytical processing (OLAP) component), and BackOffice Server.

Such initiatives have led to an overall more objective means of measuring all employees in meeting the goals of the corporation by quantifying and measuring the tasks and responsibilities assigned to each, and hopefully

rewarding each based on merit. One element often used today in this process is the "Key Performance Indicator (KPI)." KPIs represent the assignment of a metric to an event, result, or activity which management believes provides insight into how "well" the business is performing. Examples of KPIs are goal achievement, measures of progress, and system condition. As in traditional reporting however, KPIs are still measured and reported on at the "end of period," whether that "end of period" be a month, quarter, annual or other period. In these traditional reporting systems, there is also usually a process of "filtering," "shaping" or "conditioning" the information before it gets "passed up the line" to a more senior level.

Significant shortcomings in all these processes are the latency typically experienced by current reporting systems and the possible masking of key factors via filtering, shaping, or conditioning of important facts. That is, managers and executives often wait until the "end of period" for metrics that tell them how the business is doing against plan, and often only see these results through prisms provided by others. Such delayed and filtered feedback is an impediment to achieving competitive advantage via more timely, unfiltered reporting and feedback mechanisms.

Senior executives need a sound analytical basis derived from accurate, valid, and timely information for short- and long-term planning and for allocating scarce resources. Information Variance And Analysis Notices (IVAANs™) represent the application of intelligent agents in the network to report on business activity as it takes place, i.e., in real-time, with no human intervention, versus at traditional "end of period" intervals, in order to deliver time-based competitive advantage, permitting a focused, management by exception initiative. This article conceptualizes the transition of intelligent agents utilized in network performance management into the infrastructure of advanced business information systems.

2. Intelligent Agent Definition, Key Characteristics and Issues

Intelligent agents, despite being over three decades old, have grown in popularity due to the Internet. From a worldwide perspective, however, the research on intelligent agents and their applications in information retrieval and filtering, advising and focusing, entertainment, e-commerce and groupware is still in its infancy. Many proposals for a formal definition of "intelligent agent" have been made, but none has been widely accepted [Franklin and Graesser, 1996]. The following are a few of the more promising definitions:

"An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors" [Russell and Norvig, 1995]."Let us define an agent as a persistent software entity dedicated to a specific purpose. 'Persistent' distinguishes agents from subroutines; agents have their own ideas about how to accomplish tasks, their own agendas. 'Special purpose' distinguishes them from other entire multifunction applications; agents are typically much smaller" [Smith, Cypher, and Spohrer, 1994]. "Intelligent agents are software entities that carry out some set of operations on behalf of a user or another program with some degree of independence or autonomy, and in so doing, employ some knowledge or representation of the user's goals or desires" (The IBM Agent). "An autonomous agent is 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 effect what it senses in the future" [Franklin and Graesser, 1996].

"Autonomous agents are 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" [Maes, 1994]. This paper follows the definition by Andolsen [1999] which states that " Intelligent agents are software applications that follow instructions given by their creators and which "learn" independently about the information they are programmed to gather. They save time and simplify the complex world of information management. An intelligent agent can anticipate the need for information, automate a complex process, take independent action to improve a process, or communicate with other agents to collaborate on tasks and share information."

Some of the key terms found in the preceding definitions are: sensing, environment, persistent, 'own agendas', autonomy, goals, and knowledge. This paper focuses on these characteristics of intelligent agents and uses the term intelligent agents as synonymous to intelligent software agents. Ma [1999] defines intelligent/mobile/multi-system/profiling agents as working through actions and characterizes agents as "atomic, software entities that operate through autonomous actions on behalf of the user-machines and humans-without human intervention." Each of these terms seems to appropriately describe characteristics of an intelligent agent, yet none of them has gained wide recognition as *the* definition of an intelligent (software) agent.

Intelligent agents generally exhibit the following characteristics [Andolsen, 1999; Franklin and Graesser, 1996]:

- Autonomous; each agent controls its own actions
- Goal driven; the agent has a specific purpose and acts in accord with that purpose
- Impersonal; the agent does not have feelings and operates without emotion, subjectivity, or bias

- Social; The agent encapsulates event generation and strategies for negotiation
- Continuous; the agent has the ability to continuously monitor its environment based on changing conditions while referencing and updating a heuristic database
- Adaptive; the agent affects and learns from its environment through self-adaptability. Some agents can change their actions based upon previous experience and new encounters
- Intelligent; the agent interprets the monitored events, and uses reasoning and learning to make appropriate decisions
- Hyperoptic; a good agent recognizes related information even if not explicitly included in its search criteria.

Agents may also have other attributes such as security and mobility. We primarily view agents from the perspective of infrastructure, but in implementation they are usually Java/C++ -based modules of code with advanced rules and information bases in place to measure, act, and represent end-user goals, desires, and preferences. It is important to note that the terms "intelligent agents" and "agents" are not necessarily synonymous. Some agents do not have the "intelligence" attribute, yet they can still appropriately be classified as agents.

3. IVAAN™: Definition and Application

IVAAN™s are intelligent agents (neural/software agents) similar to those used in network management systems (such as Computer Associate's "Neugents"), to timely, accurately, and objectively report on executive and managerial performance relative to deviations from corporate plan(s). That is, by establishing areas of responsibility and assigning quantifiable measures to these areas of responsibility (Key Performance Indicators—KPIs), "Management By Exception" may be achieved in an automated, timely, unfiltered, and objective manner. Hence IVAAN™ notices mitigate to a significant degree information overload by delivering to the appropriate party timely exception information. The IVAAN concept is illustrated in Figure 1.

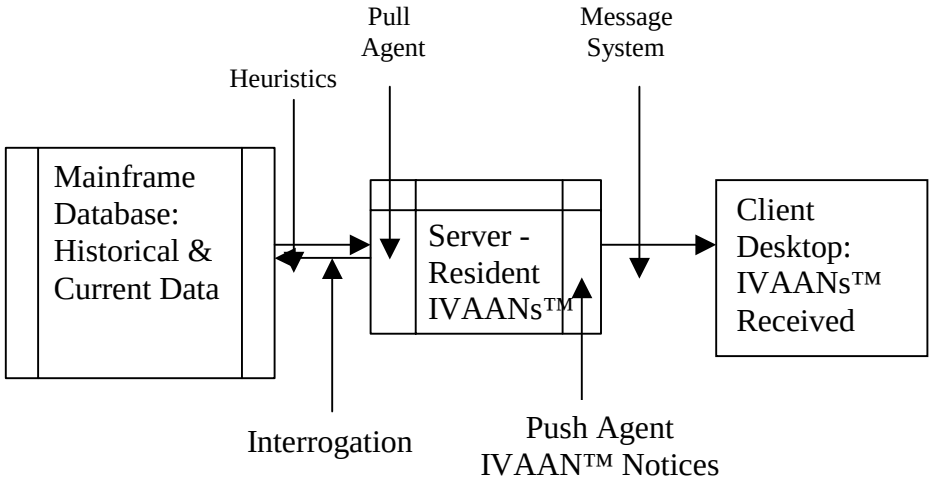

Figure 1: IVAAN™ Concept

IVAAN™ notices facilitate a management team's ability to systematically and intelligently monitor, and have reported to it, via the company email or other messaging system(s), in real time without human intervention, deviations from corporate plan(s), or deviations on any other metric(s) it wishes to establish at any time, automatically via the employment of IVAAN™ neural agents. Measurements of deviations and automated reporting of identified metrics, or KPIs, may be based on company internal or external information.

For example, Company A's management defines "churn" (customer attrition) as a KPI central to its business case. At annual planning time, management sets as a goal 12% churn for the annual plan period. Previous churn rates have averaged between 10 and 16% per annum. Bob is the responsible party for managing customer churn. In this instance, an IVAAN™ could be established for churn such that if in any given period churn deviates (more or less) by more than some threshold (say 5%)—the planned rate for that day, month, quarter, etc.—a scripted message is immediately sent to Bob alerting him to this fact. IVAANs™ could consider past churn activity for like previous

periods and other pertinent conditions impacting churn during those like periods, and compare it to current activity. Such immediate attention to deviations would provide an early warning system that hopefully yields early problem resolution or permits exploitation of beneficial occurrences.

This automated, intelligent "Management By Exception," script based, real time variance analysis reporting system obviates the necessity to wade through lengthy monthly (or other period) corporate financial or other reports searching for deviations from plan(s). For IVAAN™ not only seeks out and identifies the variance(s) from plan(s), but also immediately notifies the responsible party and that party's boss via the company email (or other messaging) system of the variance(s) from plan(s). Other information addressees may be added to any IVAAN™ KPI variation notice desired. KPI thresholds and targets are established during the annual (or other) planning or budgeting process. An added management feature of this system is the automated retention of IVAAN™ notices issued during a period in order to better, and more objectively, rate managerial and executive performance during review periods (positive versus negative IVAAN™ notices).

A tiered IVAAN™ analysis and variance reporting system may be implemented at as many levels of management as is desired. It could be the key for a successful knowledge management strategy. The goal is to map recurring questions to relevant answers. Although this is a relatively new area, solutions are appearing that handle questions via e-mail, search large knowledge bases and interact with the user via chatterbots. The combination of natural language processing with additional intelligent software processing components promises to deliver real-time, conversational solutions.

4. Principal IVAAN™ Characteristics

The IVAAN™ intelligent agent concept clearly incorporates the key characteristics of intelligent agents delineated as follows:

- Script based, automated, monitoring, measuring, reporting and tracking system.
- Resides on the network.
- Operates in near real time.
- Apply as a "Management by Exception" protocol.
- Precise information sent to responsible party, and others if desired, automatically.
- Addresses a dilemma that affects many senior executives and managers: information overload, filtering, and "end of period" latencies.
- No need to hunt out results pertaining to key measures.
- No delays in receiving unbiased critical information and measures.
- IVAAN™ notices must be responded to within a defined period by the responsible manager or executive. This helps convert information to action.
- Creates a type of objective performance measure for managers and executives.
- Creates potential for reduced cycle times yielding competitive advantage.

5. Network Tools Review: **IVAANs™**

The design and development of complex application systems such as intelligent agent-based architecture used in IVAAN™ requires the use of phase-oriented design methods and the use of network tools. The phase oriented design methods include extensions of the functional program logic (i.e., structured development life cycle and/or rapid/joint application development) such as object-oriented development and/or component-based development [Brenner et al., 1998]. The agents are modeled as objects/components which consist of attributes and methods, and communicate with each other by invoking methods or by sending messages, and use classical object-oriented concepts, such as abstraction, encapsulation, inheritance or polymorphism. Objects in a component-based system are able to communicate and cooperate with each other over network and platform boundaries in a platform (i.e., hardware, software, database, network) neutral distributed environment and independent of their implementation. Other network tools that encapsulate data and processes that are relevant in the context of IVAAN™ are:

- PUSH AGENTS - TIMELY KEY PERFORMANCE INFORMATION DELIVERED TO YOUR DESKTOP.

  Push technologies allow suppliers to "push" pre-subscribed or unsolicited information about their product/services down the distribution channel by automated delivery of specific information from a web server to a customer's hard drive. Although pull technologies, which involve a proactive request by the customer for information, still predominate, the application of push technologies is increasing especially for intranet users.

Intelligent agent software such as IVAAN™ runs in the background to reduce the workload involved in locating, evaluating, negotiating and purchasing products and services on the Internet. It performs tasks such as information gathering, information filtering, and mediation for the users.

- PULL AGENTS - AN INFORMATION FILTER: MANAGEMENT BY EXCEPTION.

Pull agents can assist in addressing the issue of "information overload." They can filter out unnecessary information through powerful search engine technology that enables users to retrieve information that is relevant and specific to them. This is an incredible benefit that any user can benefit from immensely. It not only saves the user hours of time in doing a search, but also can be used as a mechanism for researching and shopping by allowing the user to negotiate through the use of intelligent agent technology once he/she filters down to the exact items he/she is interested in purchasing. A great example of this technology is the product BullsEye 2, a search engine with customizable intelligent agents (Dow Jones Interactive Newsstand, 2000).

- MESSAGING SYSTEMS - TIMELY DELIVERY OF KEY PERFORMANCE INFORMATION.

Messaging systems are an application of intelligent agents that can assist tremendously in systems management by automating many tasks and providing useful alert mechanisms to request human involvement when necessary. Ultimately, the goal would be to have a self-healing system that would correct itself when it encounters potential systems problems. Some excellent examples of this are *Social Intelligence Server* from NetSage and Unicenter Neugents from Computer Associates. This is but a first step on a long road that may well bring us to the world of truly self-managing systems [Mason, 1998; Muller, 1998]. This technology uses a predictive model that will warn of an impending problem before it actually occurs.

Additional applications of intelligent agents include operating systems agents, spreadsheet agents, user interface agents, workflow and task management agents, software development agents and negotiation agents. Messaging systems in intelligent agents will become more critical as networks continue to grow on an international basis. More importantly, in today's global economy, having the capability to effectively monitor local and remote systems will be essential for organizations that are under pressure to minimize staff and reduce operating costs.

- Neural network agents such as Computer Associates' "Neugents" and Social Intelligence Server from NetSage. Neugents "predict" system failures, security breaches, and other possible problems by learning usage and other patterns of corporate computer systems and then analyzing data to search for anomalies. Systems managers are alerted when Neugents detect a possible problem area. Neugents also let managers know what the probability is for a given problem. The different Neugent packages will focus on three areas of prediction: 1) the likelihood of check-kiting, or bad checks being written by a customer for payment, 2) the probability that a customer will commit a fraudulent act related to an electronic-business transaction, and 3) account delinquency. There have been tremendous strides in the early stages of intelligent agent technologies. Great examples of these accomplishments are relevant in products like Social Intelligence Server from NetSage, and Neugents from Computer Associates, which also serve, as messaging systems as discussed above. Both of these products actually learn from their environment using a self-learning algorithm, and then modify their responses from their learned behavior to be included in future requests. They not only can process a large amount of data but also instantly identify complex patterns and relationships for better predictions than traditional forecasting methods or rules-based applications.
- Technology exists; just applying underlying tools in a new manner for a new purpose.

New tools like intelligent agents, extensible markup language (XML), directory services and quick-change (parametric) technology are enabling business managers, without any technical handholding, to instantly create dynamic and customized applications. With the growth of virtual communities, users want utility, content, personalization, security and a community culture that appeals to them. Community dwellers are searching for features that allow them to feel "connected," informed, organized and safe. The application of IVAAN™ in virtual communities could have an unparalleled advantage in winning over loyal users. For instance, IVAAN™ neural agents could facilitate a management team's ability to systematically and intelligently monitor, and have reported to it automatically, via the company email or other messaging system(s), in real time without human intervention, deviations from corporate plan(s), or deviations on any other metric(s) it wishes to establish at any time. Measurements of deviations and automated reporting of identified metrics, or Key Performance Indicators (KPIs), such as measurements of visitor retention or how much time a visitor spends on the website and the frequency of visits, may be used to enhance the "stickiness" of a website. By measuring deviances in customer browsing and purchasing behavior, exceeding customer service standards by anticipating their needs

and shaping positive customer experiences from the first visit on, IVAAN™ could help a site become "sticky," with more repeat visitors.

6. Management Tools Review

The Gartner Group projects greater than 500% growth in the use of intelligent agents between 1999 and 2004, from 13% to 84%. Most of this activity will revolve around monitoring data streams, detecting events and managing/retrieving information [Linden, 1999]. Intelligent agents are being employed to enhance information systems including e-commerce servers, applications and related "backend" enterprise systems. For example, since agents are able to monitor and take action based on a particular event, they are used to alert system administrators of technical or infrastructure problems. This capability is very helpful in coping with the increasing complexity of IT systems [Dang Van Mien, 1999]. A recent report by the Gartner Group cited Stratasource's "Lights Out" Intelligent Agent solution which manages e-business applications and sites and pages the Stratasource employees for immediate service should human interaction be required [Terdiman, 2000].

Programming intelligent agents by demonstration techniques can be used by managers not only during the initial agent-training phase but also during execution of procedures the agent has so acquired. This scenario described by [Bauer et al., 2000] requires the system to account for its users much more carefully than they are in conventional programming by demonstration scenarios. Early informal tests with nonprogrammer users indicate that the training mechanism outlined enables many of them to deal with the subtleties of procedures for identifying problems involved in extracting information from Web-based sources.

7. Next Generation Executive Information Systems and IVAAN™

Executive Information Systems (EIS) are computer-based systems that belong to the broad category of management decision systems. The EIS was intended to enhance top management efficiency and effectiveness by modifying, streamlining, and hence, improving information and communication flows. [Bajwa, Rai, & Ramaprasad 1998] elaborate on the intent of instituting an EIS - to achieve a better "organization-environment fit" in a situation where a company must react to both internal and external pressures. There are three environmental characteristics which, in combination, are positively correlated to the adoption of an EIS:

1) "Heterogeneity" or variations in the firm's environments mandating quick action with the codicil that these varied responses must be woven into a coherent strategy;

2) "Dynamism" or a situation in which it is difficult to predict competitors' moves and consumers' demands.

3) "Hostility" or competitive pressures faced by a firm due to price competition, quality competition, and shrinking markets for products.

It appears that a strong argument in justifying a next generation EIS, which uses tools such as IVAAN™, as a capital asset is the necessity to manage disparate data and generation of information from such data. "With the increased development of external databases and the advent of intelligent agent technology that enables the scanning of external environments for price and product competition, EIS capabilities can be expected to become increasingly helpful in understanding and managing environmental hostility" [Bajwa, Rai & Ramaprasad, 1998, p.35].

An earlier empirical study of 46 senior managers by [Vandenbosch & Huff 1997] across representative industry classifications supported the hypothesis that frequency of use of an EIS positively impacted identification of problem, speed of decision making, and extent of analysis. This was particularly true when multiple alternatives had to be considered simultaneously.

The act of acquiring information falls along a continuum [Vandenbosch & Huff, 1997]: undirected viewing defined as general exposure when viewer has no specific purpose in mind conditioned viewing or directed exposure not involving active search informal search which refers to an unstructured effort to obtain information deliberate effort to find a piece of information. Some executives use their systems every day or several times a day for automated briefing, exceptions reporting, and active exploring. Typically an executive will examine a predefined set of reports, retrieve information by scanning or generally browsing, or initiate a focused search for the answer to a specific problem. Scanning is more likely to produce gains in effectiveness, focused search in efficiency.

Although, fine tuning operations or efficiency seem to be the goal of a focused search, IVAAN's™ use as a next generation EIS tool may also lead an executive to challenge fundamental managerial assumptions and preconceptions when using the technique to scan through information without having any specific questions in mind. Thus, scanning fosters creativity thereby improving organizational effectiveness since the user's attention is caught by a wide range of variables when making a decision, whereas a focused search limits creative insights.

Chief executives in high performing companies scan more frequently and more broadly in response to strategic uncertainty than those in low performing companies. In fact, propensity to scan or browse for information can be depicted as an inverted U shape, with the two ends depicting the user's perception of the most stable and the most

unstable extremes. In organizations facing decline, executives tend to rely on highly formal, focused information, conducting less broadly targeted, informal scanning. In fact, it is thought that information systems that are structured to curtail environmental scanning activities in order to become more efficient, may actually precipitate their decline.

8. Scanning Content

This leads to the next point - what is actually scanned? Much of executive decision making is based on soft information, categorized as opinion, predictions, news and even rumors. EIS have only recently begun to augment factual data with this type of information. What kinds are most valuable and how can companies best capture and deliver this information? Locating needed information can be very time consuming and difficult. Personal scanning is no longer effective or efficient. Critical information will be missed simply because no one can scan enough. So how does a company respond to change? With next generation EIS tools that can quickly deliver relevant, up-to-date and accurate information. Most EIS have been developed as an information silo by business function. This ignores the multidimensionality of information. Intelligent agent based EIS can be shown to support integrated learning.

Finally, executives need to confirm what they receive with their own mental models. We navigate through the complexity of our multiple environments by using them as a gyroscope of sorts. The theory is that managers consciously create these mental models to improve their understanding of how a business works in their environment. This inner mode of reality is critical in a manager's success and managers need to share a common view of their organization. There has been a lack of semantic guidance in using an EIS to improve understanding of data from information bases in terms of context. In other words, the system has not facilitated capturing the reality of an organization's complex structural relationships.

Managers should never deal with problems in isolation. They should always ask themselves what additional related issues they should be aware of while dealing with the problem at hand. The most significant contribution of a next generation EIS tool such as IVAAN™ may be its potential to enhance and universalize the mental model used by decision makers. The quality of that model may impact how effectively executives use information.

9. IVAAN™: An Assessment of the Key Issues

The state of the research and the practical applications are still in their infancy with much on the horizon with regard to the evolution of intelligent agent technology. There are many challenges and issues faced when deploying intelligent service systems. From a technological perspective, many organizations have a number of disparate systems from which data is drawn both internally and externally to facilitate the management of corporate objectives and strategies. The seamless integration of these heterogeneous platforms with IVAAN™ would be critical in its widespread implementation. From an economic perspective, the potential of IVAAN™ to be cost effective and enhance productivity by providing accurate and timely feedback is yet unrealized and thus remains a risk factor. From a social perspective, just as in the measurement of non-managerial performance via SIS techniques, the fact remains that people do not like to feel they are being watched and constantly measured. Hence, the difficulty with all measurement systems is the element of oversight that must be mitigated to a significant degree such that the employee, at whatever level, sees the IVAAN™ tool as a help and not a hindrance or threat in achieving the tasks and responsibilities assigned to that employee. This aspect may be even more difficult to inculcate into employee psyche, since the amount of time an employee has to receive, digest, analyze, and respond to a manager or executive concerning a deviation from plan of a KPI will be drastically shortened via IVAAN™ implementations. Management needs to be sensitive to the social implications of monitoring employee behavior and performance. A tiered implementation of IVAAN™ that provides backup and support for an employee would help reduce employee stress and co-developing (by consulting the end-users) realistic response time goals and strategic targets would help its widespread acceptance and usage within the organization.

As was recently reported in The Wall Street Journal [Anonymous, 2000], great stress is often created in the measurement of employees' activities. Here, the Communications Workers of America was citing the stress impacts of the constant monitoring and performance management of call center operators. Such stress is believed to be universal to virtually all enterprise workers regardless of position or level.

This concern is exacerbated by the fact that each employee knows his/her manager is receiving a copy of the IVAAN™ notice, an unfiltered KPI measurement against plan for which the respective employee is responsible, at the same exact time as the respective employee. Such notices may put undue stress on the employee with requirements to respond in far shorter time frames than was heretofore expected.

Moreover, as IVAAN™ notices may be stored, accumulated, analyzed, and ranked, they may be used at employee appraisal measurement periods as one objective measurement of employee performance (number of positive versus negative IVAAN™ notices). Employees will know nothing will be missed, overlooked, or forgotten.

This "big brother" aspect of the IVAAN™ system is of significant concern in dealing with and overcoming inherent human concerns about being watched and measured all the time while having shorter time intervals to respond. In another regard, IVAAN™ notices will not measure all management performance. For instance, it is difficult to see how IVAANs™ could measure the quality of employee relations.

10. Conclusion

This paper conceptualizes the transition of intelligent agents utilized in network performance management into the field of business and management. The tiered IVAAN™ system could be implemented at many levels of management and could be the key for successful, timely knowledge management strategies and successes. Clearly the tools exist today to implement an IVAAN™ system to monitor and timely report on KPIs in virtual real-time, just as is done today in network monitoring and management with tools such as Computer Associates' neural agents called "Neugents" [Computer Associates, 2000]. Such a system would be timely, unbiased, objective, and should provide significant competitive advantages. Moreover, such a system could leverage existing assets and provide a single objective measure of employee performance at appraisal time.

However, the implementation of such a system might also create negative aspects that mitigate the value of time-based competitive advantage. Namely, employee morale could be negatively impacted to the degree that the benefits of the IVAAN™ system might be outweighed. Therefore, if an IVAAN™ system is implemented, effort must be made to use this tool to help employees do their jobs more efficiently, and efforts must be also taken to show that this is not "big brother" watching an employee's every move. There are tremendous competitive advantages to employing the IVAAN™ system if the social impacts on employees can be dealt with positively.

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