Asian Social Science
www.ccsenet.org/journal.html
Vol. 5, No. 6
June 2009

Predicting Knowledge Creation Behavior in Organizations: A General Systems Theory Perspective

Mostafa Jafari
Department of Industrial Engineering, Iran University of Science and Technology (IUST)
Narmak, PO box 1684613114, Tehran, Iran
Tel: 98-21-7391-3000 E-mail: jafari@iust.ac.ir

Atieh Bourouni (Corresponding author)
Department of Industrial Engineering, Iran University of Science and Technology (IUST)
Narmak, PO box 1684613114, Tehran, Iran
E-mail: bourouni@ind.iust.ac.ir

Roozbeh Hesam Amiri
Department of Industrial Engineering, Iran University of Science and Technology (IUST)
Narmak, PO box 1684613114, Tehran, Iran
Tel: 98-912-5356-487 E-mail: amiri_r@ind.iust.ac.ir

Abstract

Knowledge creation has been widely recognized to be strategically important for organizational learning and innovation. The lack of empirical work in this area has limited our understanding of this important phenomenon. Previous studies have focused on limited aspects of the overall knowledge creation process, such as inter-organizational knowledge transfer, knowledge flows within the firms and the interplay of tacit and explicit knowledge. In developing countries, there is a sense that rich countries have failed to create knowledge that is appropriate to local needs. This study is a comprehensive analysis of the knowledge creation behavior by using general systems theory and HIV/AIDS epidemic which can help us to better understand of this process.

Keywords: HIV/AIDS epidemic, Agent based modeling, Knowledge creation, Social behavior and General Systems Theory (GST)

1. Introduction

The concept of knowledge is as old as the history of human civilization (Pillania, 2008a). In addition, Knowledge management has emerged as an important research topic for information systems and management researchers since the 1990s (e.g., Alavi and Leidner, 2001; Davenport and Grover, 2001; Hahn and Subramani, 2000; Nonaka, 1991, 1994).

New knowledge creation has received increasing attention, recognition and importance in recent past in the business world. Knowledge has emerged as the most important strategic resource for organizations (Toffler, 1990; Nonaka, 1991; Barney, 1991; Bartlett and Ghosal, 1993; Drucker, 1993; Stewart, 1997; Pillania, 2005, b; Pillania, 2008b). It is not only the big organizations; new knowledge creation has increasingly become critical for small and medium-size enterprises (SMEs) also. The need for knowledge renewal is particularly acute in SMEs (Pillania, 2006; Martin et al., 2002).

While knowledge creation is fundamental to the survival of a business, it has not been extensively researched beyond organizational theory (Chen, 2005). Alavi and Leidner (2001) consider the firm's ability to create knowledge and to take action upon it as the basis for competitive advantage.

The enormous amount of studies and research carried out on the process of knowledge creation in organizations in recent years is an indisputable reality (Choo and Bontis, 2002; Crossan et al., 1999; Holmqvist, 2003; Leonard and Sensiper, 1998; Nonaka and Takeuchi, 1995; Wikström and Normann, 1994).

The propose of this article is better understanding of knowledge creation process by using of general systems theory as a powerful tool to linkage different area of science and using simulation without creating a separated model for this field. Therefore we can predict the behavior of knowledge creation by playing with AIDS epidemic parameters in the manner which is adapted by their organizational parameters.

In this article, we will introduce general systems theory in a nutshell, and then describe an agent-based approach to HIV/AIDS epidemic. For that purpose, at first AIDS epidemic will be presented, then agents and agent based modeling will be surveyed, after that HIV/AIDS will be modeled by using of agent based model and at the last, the behavior of knowledge creation will be predicted.

2. General Systems Theory

Ludwig von Bertalanffy gave us the General Systems Theory (GST). He did not merely give birth to a new field but also nurtured it and projected its future possibilities as an epistemology and ideology.

The time of GST's raise – the middle of the century – was the "hour of triumph" of science (particularly in nuclear physics, electronics and molecular biology). That partially explains Bertalanffy's choice to look for the solutions on complexity problems, wholeness and so on in the exact sciences: "GST is a logico-mathematical science of wholeness" (Skyttner, 1996). Bertalanffy, in his famous paper, described that (Bertalanffy, 1955):

"There exist models, principles and laws that apply to generalized systems or their subclasses, irrespective of their particular kind, the nature of their component elements and the relations of forces between them. It seems legitimate to ask for a theory of universal principles applying to systems in general; not of systems of a more or less special kind."

Therefore, a first consequence of this theory is the appearance of structural similarities or isomorphism in different fields. There are correspondences in the principles which govern the behavior of entities that are intrinsically, widely different (Bertalanffy, 1955).

By summarizing and totaling the researchers in this article, the aims of general systems theory are (Bertalanffy, 1955; Skyttner, 1996; Boulding, 1964; Mulej et al, 2004):

1) There is a general tendency towards integration in the various sciences.
2) Such integration seems to be centered in a general theory of systems.
3) Such theory may be an important means for aiming at exact theory in the non-physical fields of science.
4) Developing unifying principles running vertically through the universes of the individual sciences, brings us to the goal of the unity of science.
5) This can lead to a much-needed integration in scientific education.

3. An agent-based approach to HIV/AIDS epidemic

Since AIDS was first discovered, mathematical models of the transmission dynamics of HIV have been developed to determine the drivers of the epidemic. It has become apparent that the most profound factor in the proliferation of this disease is the aggregate effects of individual behavior and perception of risk. Agent-based models (ABM) allow one to simulate the social and sexual interactions which may describe the societal context in which HIV may spread.

Ultimately, the purpose of HIV transmission models is to hypothesize about drivers of the epidemic which will then shed light on appropriate interventions and prevention measures. ABMs facilitate the development of network-based public health interventions. Such interventions, like home-based care programs, may have great promise in anywhere.

4. The AIDS epidemic

UNAIDS estimates more than 60 million people have contracted HIV/AIDS worldwide in the past two decades and 25 million have died as a result - it is the fourth-leading cause of death in the world (Hein and Wilson, 2002).

Currently, Sub-Saharan Africa is the most seriously impacted region in the world – with 9% of all its inhabitants between the ages of 15 – 49 infected with HIV. Eurasia, however, is expected to be the next major area of infection, and the region includes three of the world's largest nations, China, Russia and India. The toll, in terms of human suffering will be tremendous, but, combined with the potential economic, social and political impacts, the epidemic will have staggering implications inside and outside the region (Hein and Wilson, 2002).

The HIV/AIDS model has two key modules: the disease progression module and the economic module, but the approach consists of a collection of integrated analytic solutions. The disease module is primarily a model of heterosexual transmission that incorporates multiple risk groups. In the economic module models specific industrial segments: information technology, financial services, and automotive. Economic impact of HIV/AIDS was captured through worker morbidity and mortality. There were a variety of program and policy options that were incorporated into our model. Programs included both prevention and treatment options. Prevention programs were modeled both at the industry and national levels and consisted of: general education and wellness, voluntary counseling and testing, condom distribution, and mother to child transmission prevention programs (Markus, 2004).

5. What is an agent?

Up to now, no general agreement on the term agent has yet been established (Tripathi et al., 2005). Parunak et al. (1998) define an agent as being a software entity with its own thread of control able to execute operations without being externally invoked, while Jennings et al. (1998) define an agent as a self-contained, problem-solving entity. The Merriam web dictionary defines "agent" as an entity that produces or is capable of producing an effect for an active or efficient cause (Web: Merriam-Webster online dictionary, 2009).

Agents exhibit certain characteristics which explain the functions that agent can perform. Some common characteristics of agents are (Malik, 2007; Jennings, 2000a; Jennings, 2000b; Jennings, 1996; Shehory, 1998): Reactive, Communication richness, Goal-oriented, Autonomy, Temporal Continuity, Proactive, Concurrency, Distribution and Adaptability.

The agents perceive the state of the environment, and then act according to the information they possess. They may change either some objects in the environment or themselves, for instance by moving relative to the other agents (Laine, 2006).

The simulation of agent and their interactions in known by several names, including agent based modeling, bottom-up modeling and artificial social systems (Axelord, 1997a). This type of modeling was introduced below.

6. Agent based modeling

Many social systems such as organizations are inherently nonlinear. That is the effects of independent variables representing policy decisions on dependent variables or outcomes are not proportional and directly predictable. It is difficult to model such nonlinear systems because they cannot be understood analytically (Gilbert N, 1999). The behavior of the system cannot be predicted from a set of equations. The only effective way of exploring the behavior of nonlinear systems is by building and running simulation models. Two different approaches to modeling nonlinear systems have been developed; system dynamics and agent based modeling (Anderson, 2007). Forrester's (1969) early studies represent efforts within the systems dynamics field to simulate the growth of urban areas and systems dynamicity continue to explore social system and organizational dynamics (Richardson, 1996). In contrast, ABM represents a new paradigm in modeling and simulation of dynamic systems distributed in time and space (Jennings et al., 1998; Lim and Zhang, 2003). It examines the global consequences of interactions among individual agents (Wakeland, 2004). The ABM approach is highly appropriate for these types of systems (Lim and Zhang, 2003; Nilsson, 2005; Wakeland et al., 2004). There is a growing interest in using ABM in several business-related areas, such as manufacturing (Chun et al., 2003; Kotak et al., 2003; Lim and Zhang, 2003; Zhou et al., 2003) and logistics and supply chain management (Gerber et al., 2003; Kaihara, 2003; Knirsch and Timm, 1999; Santos et al., 2003; Schieritz and Grossler, 2003). ABM is considered important for developing industrial systems (Davidsson and Wernstedt, 2002; Fox et al., 2000; Karageorgos et al., 2003) and it provides a pragmatic approach for the evaluation of management alternatives (Swaminathan et al., 1998).

In ABM the focus is on agents and their relationships with other agents or entities (Axelrod, 1997b; Cicirello and Smith, 2004; d'Inverno and Luck, 2001; Jennings et al., 1998). The state of agents making up the environment varies as the simulation moves through time. Thus, an agent based model consists of two distinct parts: An environment and agents.

7. Modeling HIV/AIDS by agent based model

Alisa Joy Rhee (2006) in her thesis, inspected AIDS epidemic by using of agent based modeling. She supposed three scenarios which has different epidemic probabilities which are shown in table1. She also ran her model with 2000 as its population size and 0.005 per day as probability of epidemic. The model was run at one hundred 9000 time step Monte Carlo realizations. Suppose that k_3 is described to quantify the amount of partnerships in a network and mathematically is approximated by:

$$\frac{\sigma^2}{\mu}+\mu-1 \tag{1}$$

Where σ^2 and μ are the variance and mean of the number of relations per person observed in the network.

Scenarios 1-3 are ordered by degree of concurrency: scenario 1 has the greatest proportion of agents in monogamous partnerships, and the lowest proportion of multiple concurrent partnerships; scenario 3 has the greatest amount of concurrency, with a greater proportion of individuals in multiple concurrent partnerships.

The epidemic curves of the three scenarios are plotted in Figure 1.

The epidemic begins the slowest in scenario 3 because the scale-free network also has the highest proportion of singles of all three scenarios; the epidemic is slow to spread immediately after HIV is seeded in the population. In Figure 1, HIV prevalence begins to increase more rapidly in scenario 3 than the others at the end of 30 months.

As shown in Figure 2, after one year, the prevalence in scenario 3 increases faster than scenarios 1 and 2 which have fewer concurrent partnerships. Therefore prevalence is growing fastest in scenario 3 and slowest for scenario 1.

8. Similarities between AIDS epidemic and knowledge creation

There are some similarities between AIDS epidemic and knowledge creation which can help us to use general systems theory to link their behavior to each other. Therefore in Table 2, we have proved that the properties of knowledge creation in an organization and AIDS epidemic are similar and according to general systems theory we can claim that their behavior under specific situations are the same.

9. Results

As shown above, the properties of AIDS epidemic and knowledge creation are the same and we can predict the behavior of knowledge creation in an organization by using of general systems theory and the agent model of HIV/AIDS epidemic. Therefore, we can predict that whether employees in different departments can have interactions with each other and share their knowledge, the process of knowledge creation becomes faster and is performed better (scenario 3) because proportion of individuals is greater and amount of concurrency is at the greatest level but in those situations whose proportion of individuals in monogamous partnerships is greatest, and proportion of multiple concurrent partnerships is at the lowest level (scenario 1 and 2) the process of knowledge creation is slower and don't perform as well as the process in scenario 3.

We can infer that the work groups in an organization should contain different experts in various fields who have great agreement with each others. In these group types, we can have the highest level of knowledge creation with better quality. We should notice that, each organization have their own situation and parameters and these result can be quite different in some organizations. They can play with HIV/AIDS model's parameters and gain their suitable results.

10. Conclusion

As a result, our understanding of knowledge creation is limited to certain micro-level aspects, rather than understanding the process in its entirety. Therefore, having a model which can predict knowledge creation behavior is very important. Whereas building a suitable model for each organization with their own situation is a too hard work, in this article we applied one of the most applicable models of epidemic to our research. As we look further back into the knowledge creation process we see that informal networking is crucial. However, senior managers are uncomfortable with things that cannot be managed. Hence, it is important to understand that although informal networking is critical there is a link between formal and informal networking. The used agent based model of HIV/AIDS epidemic considers the both formal and informal factors and by using of general systems theory, we deduced the knowledge creation behavior in organizations.

References

Alavi, M., & Leidner, D.E. (2001). Review: Knowledge Management and knowledge management systems: Conceptual foundations and research Issues. *MIS Quarterly*, 1, 25, 107-136.

Anderson, J., Chaturvedi, A., & Cibulskis, M. (2007). Simulation tools for developing policies for complex systems: Modeling the health and safety of refugee communities. *Health Care Manage Sci*, 10, 331-339.

Axelord, R. (1997a). *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration*. Princeton, NJ: Princeton University Press.

Axelrod, R. (1997b). Advancing the art of simulation in the social sciences. *Complexity*, 3, 2, 16-22.

Barney, J.B. (1991). Firm resources and sustainable competitive advantage. *Journal of Management*, 17, 2, 99-120.

Bartlett, C.A., & Ghosal, S. (1993). Beyond the M-form: toward a managerial theory of the firm. *Strategic Management Journal*, 14, 3, 23-46.

Boulding, K. (1964). *General systems as a point of view*, in Mesarovic, J., Views on General Systems Theory. New York, NY: John Wiley.

Chen, A. N. K., & Edgintin, T. M. (2005). Assessing value in organizational knowledge creation: Considerations for knowledge workers. *MIS Quarterly*, 29, 2, 279-309.

Choo, C.W., & Bontis, N. (2002). *The Strategic Management of Intellectual Capital and Organizational Knowledge*. Oxford: Oxford University Press.

Chun, W., Weiming, S., & Ghenniwa, H. (2003). An adaptive negotiation framework for agent based dynamic manufacturing scheduling. *International Conference on Systems, Man and Cybernetics*, IEEE, 2, 1211-1216.

Cicirello, V.A., & Smith, S.F. (2004). Wasp-like agents for distributed factory coordination. *Autonomous Agents and Multi-Agent Systems*, 8, 3, 237-266.

Crossan, M.M., Lane, H.W., & White, R.E. (1999). An organizational learning framework: from intuition to institution. *Academy of Management Review*, 24, 3, 522-537.

d'Inverno, M., & Luck, M. (2001). *Understanding Agent Systems*. Berlin: Springer-Verlag.

Davenport, T., & Grover, V. (2001). Special Issue: Knowledge management (Editorial). *journal of management information systems*, 1, 18, 3-4.

Davidsson, P., Wernstedt, F. (2002). A multi-agent system architecture for coordination of just-in-time production and distribution. *The Knowledge Engineering Review*, 17, 4, 317-329.

Drucker, P.F. (1993). *Post-capitalist Society*. Oxford: Butterworth-Heinemann, 167.

Forrester, J.W. (1969). *Principles of Systems*. Cambridge, Mass: Wright-Allen Press.

Fox, M.S., Barbuceanu, M., & Teigen, R. (2000). Agent-oriented supply-chain management. *International Journal of Flexible Manufacturing Systems*, 12, Nos 2/3, 165-188.

Gerber, A., Russ, C., & Klusch, M. (2003). Supply web co-ordination by an agent-based trading network with integrated logistics services. *Electronic Commerce Research and Applications*, 2, 2, 133-146.

Gilbert, N., & Troitzsch, K.G. (1999). *Simulation for the Social Scientist*. Buckingham, UK: Open University Press.

Hahn, J., & Subramani, M. R. (2000). A framework of knowledge management systems: Issues and challenges for theory and practice. *Proceeding of the 21st international conference on information systems*, 302-312.

Hein, M., & Wilson, A. (2002). *2002 Report on the global HIV/AIDS epidemic*. Joint United Nations Programme on HIV/AIDS (UNAIDS).

Holmqvist, M. (2003). A dynamic model of intra- and interorganizational learning. *Organization Studies*, 24, 1, 95-123.

Jennings, N. R. (2000a). *On Agent-Based Software Engineering*. Artificial Intelligence, 117, 2, 277-296.

Jennings, N. R., & Wooldridge, M. (2000b). *Agent-Oriented Software Engineering*. Handbook of Agent Technology (ed. J. Bradshaw) AAAI/MIT Press.

Jennings, N. R., Faratin P., Johnson M. J., O'Brien P., & Wiegand M. E. (1996). Using Intelligent Agents to Manage Business Processes. *Proc. of PAAM96, London, UK*, 345-360.

Jennings, N.R., Sycara, K., & Wooldridge, M. (1998). A roadmap of agent research and development. *Autonomous Agents and Multi-Agent Systems*, 1, 1, 7-38.

Kaihara, T. (2003). Multi-agent based supply chain modelling with dynamic environment. *International Journal of Production Economics*, 85, 2, 263-9.

Karageorgos, A., Mehandjiev, N., Weichhart, G., & Hammerle, A. (2003). Agent-based optimisation of logistics and production planning. *Engineering Applications of Artificial Intelligence*, 16, 4, 335-48.

Knirsch, P., & Timm, I.J. (1999). Adaptive multiagent systems applied on temporal logistics networks. *Proceedings of 4th International Symposium on Logistics, Florence, Italy*, 213-218.

Kotak, D., Wu, S., Fleetwood, M., & Tamoto, H. (2003). Agent-based holonic design and operations environment for distributed manufacturing. *Computers in Industry*, 52, 2, 95-108.

Laine, Tei. (2006). Agent-Based Model Selection Framework for Complex Adaptive Systems, doctoral Thesis. Computer Science and Cognitive Science, Indiana University.

Leonard, D., & Sensiper, S. (1998). The role of tacit knowledge in group innovation. *California Management Review*, 40, 3, 112-132.

Lim, M.K., & Zhang, Z. (2003). A multi-agent based manufacturing control strategy for responsive manufacturing. *Journal of Materials Processing Technology*, 139, Nos 1/3, 379-384.

Malik, Haroon. (2007). Agent-based Approach for Minimizing the Energy Consumption among Border Nodes in Wireless Sensor Networks, Master of Science Thesis. Computer Science, Acadia University.

Markus, H. (2004). *The Macroeconomics of HIV/AIDS*, Quoted in Stevan Jackson, "New Report Warns Of Long-Term Economic Impacts From HIV/AIDS" (The World Bank Group).

Martin, C., Martin, L., & Mabbett, A. (2002). *SME Ownership Succession: Business Support and Policy Implications*. Sheffield: Small Business Service.

Merriam-Webster online dictionary. [Online] Available: http://www.m.com/dictionary/agent. (Jan, 2009)

Mulej, M., et al. (2004). How to restore Bertalanffian systems thinking. *Kybernetes*, 33, 1, 48-61.

Nilsson, F. (2005). Adaptive logistics – using complexity theory to facilitate increased effectiveness in logistics, doctoral thesis, Division of Packaging Logistics, Lund University, Lund.

Nonaka, I. (1991). The knowledge creation company. *Harvard Business Review*, 6, 69, 96-103.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *organizational science*, 1, 5, 14-37.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York, NY and Oxford: Oxford University Press.

Parunak, H. V. D., Savit, R., & Riolo, R. L. (1998). Agent-based modeling vs equation-based modeling: a case study and users guide. *Proceedings of Multiagent systems and Agent-based Simulation (MABS'98)*, Paris, 10-25.

Pillania, R. K. (2005). Leveraging knowledge: Indian industry' expectations and shortcomings. *Global Business Review*, 6, 2, 21-23.

Pillania, R. K. (2006). Leveraging knowledge for sustainable competitiveness in SMEs. *International Journal Globalization and Small Business*, 1, 4, 393-406.

Pillania, R. K. (2008a). Creation and categorization of knowledge in automotive components SMEs in India. *Management Decision*, 46, 10, 1452-1464.

Pillania, R. K. (2008b). Strategic issues in knowledge management in SMEs. *Knowledge Management Research & Practice*, 6, 4, in press.

Rhee, A.J. (2006). An agent-based approach to HIV/AIDS epidemic modeling: a case study of Papua New Guinea. *Thesis (S.M.)--Massachusetts Institute of Technology, Engineering Systems Division, Technology and Policy Program*; and, (S.M.)--Massachusetts Institute of Technology, Dept. of Civil and Environmental Engineering.

Richardson, G. P. (ED.) (1996). *Modeling for Management. Simulation in Support of Systems Thinking*, 2 volumes. Dartmouth and Aldershot.

Santos, E., Zhang, F., & Luh, P.B. (2003). Intra-organizational logistics management through multi-agent systems. *Electronic Commerce Research*, 3, Nos 3/4, 337-364.

Schieritz, N., & Grossler, A. (2003). Emergent structures in supply chains – a study integrating agent-based and system dynamics modeling. *Proceedings of the 36th Annual Hawaii International Conference on System Sciences*.

Shehory, O. (1998). Architectural Properties of Multi-Agent Systems. *Technical Report CMU-RI-TR-98-28*, The Robotics Institute, Carnegie Mellon University.

Skyttner, L. (1996). General systems theory: origin and hallmarks. *Kybernetes*, 25, 6, 16-22.

Stewart, T. A. (1997). *Intellectual Capital: The new Wealth of Organisations*. New York, NY: Doubleday, 6.

Swaminathan, J. M., Smith, S. F., & Sadeh, N. M. (1998). Modeling supply chain dynamics: a multiagent approach. *Decision Sciences*, 29, 3, 607-632.

Toffler, A. (1990). *Powershift: Knowledge, Wealth and Violence at the Edge of the 21st Century*. New York, NY: Bantam Books.

Tripathi, A. K., Tiwari, M. K., & Chan, F. T. S. (2005). Multi-agent-based approach to solve part selection and task allocation problem in flexible manufacturing systems. *International Journal of Production Research*, 43, 7, 1313-1335.

Von Bertalanffy, L. (1955). *General systems theory*. Main Currents in Modern Thought, 71-75.

Wakeland, W. W., Gallaher, E. J., Macovsky, L. M., Aktipis, C. A. (2004). A comparison of system dynamics and agent-based simulation applied to the study of cellular receptor dynamics. *In Proceedings of the 37th Hawaii International Conference on System Sciences*: 1-10.

Wikström, S., & Normann, R. (1994). *Knowledge and Value: A New Perspective on Corporate Transformation*. London: Routledge.

Zhou, Z. D., Wang, H. H., Chen, Y. P., Ong, S. K., Fuh, J. Y. H., & Nee, A. Y. C. (2003). A multi-agent-based agile scheduling model for a virtual manufacturing environment. *International Journal of Advanced Manufacturing Technology*, 21, 12, 980-984.

Table 1. Distribution of concurrency for Scenarios 1-3

Distribution of concurrency	Scenario 1	Scenario 2	Scenario 3
Network type	Random	Random	Scale-free
k_3	0.263	0.442	0.672
No partners	0.41	0.46	0.51
One partner	0.51	0.43	0.34
Two partners	0.0681	0.0951	0.1156
⋮	⋮	⋮	⋮
Over five partners	0	0.00002	0.00006

Table 2. Comparison of knowledge creation and AIDS epidemic

AIDS Epidemic	**Knowledge Creation**
HIV virus	Knowledge
Ways of widespread disease	Ways of knowledge sharing
Probability of AIDS epidemic after full peril behaviors	Probability of sharing knowledge in a relation
Population of models	Number of organization's employees
Number of patients	Number of knowledge workers
Incubation period for HIV	Needed period for catching shared knowledge
Duration of acute HIV phase	Needed period for creating knowledge from shared knowledge
Duration of latent HIV phase	period of using and sharing new knowledge by new knowledge workers
Duration from AIDS diagnosis to death	Duration which in knowledge is useable and not expired.
Death patient	Knowledge workers whose knowledge was expired
Age	Years of service
Level of education	Level of employees' education of knowledge sharing
Type of belief system of the agent	Culture of employees for knowledge sharing
Methods of AIDS prevention	Wrong beliefs to not sharing knowledge
People who observe AIDS prevention methods	People who don't share their knowledge
People who have full peril behavior	People who share their knowledge

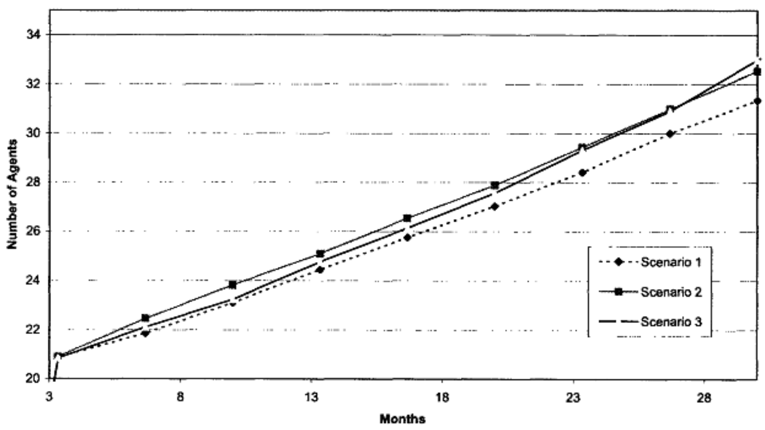

Figure 1. HIV/AIDS prevalence first 30 months

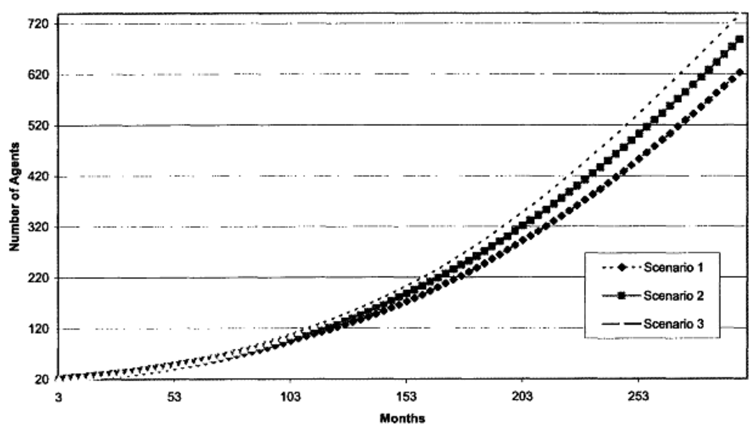

Figure 2. HIV/AIDS prevalence 20 years