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Modeling Workforce Burnout and its Consequences:A system dynamics Approach

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Abstract

In some organizations workforce balance is a key to their survival. Exogenous and endogenous changes cause highly skilled work force to quit rapidly. In this paper, a system dynamics model is developed to investigate the feedback structure of the problem and design strategies to address it through simulation and scenario analysis.

Key words

Workforce planning, System dynamics, Simulation, Scenario analysis.

Introduction

In some organizations such as law firms, hospitals, airlines, and construction companies, skilled workforce balance is a key to their success and long term survival. These organizations are always looking for policies to balance their skilled workforce to ensure the stability and quality of their services (Kor and Leblebici, 2005). Due to environmental changes and internal feedback processes, the workforces of these companies are faced with increasing pressure and burnout that result in their rapidly leaving the company.

Some of the roots of this problem are in the environment of these organizations. Population growth has increased the demand for their services. In some countries, aging population has caused a sharp increase in demand for hospitals and physicians (Koshio and Akiyama, 2008). Legal changes and awareness of customers have increased the legal actions against lawyers, construction companies, and hospitals. But the feedback structure, dynamic complexities, and strategies of these companies have exacerbated the problem. Burnout is a non linear feedback process. A long time delay exists between hiring and training of skilled workforce that makes the managing and balancing the work force highly challenging. Human cognitive capabilities are not well suited for dealing with dynamic complexity (Sterman, 2000).

In this paper, a system dynamics model is developed to investigate the feedback structure of the problem and design strategies to address it through simulation and scenario analysis. System dynamics is a method founded by J.W. Forrester in MIT and is designed to enhance learning in dynamically complex problems. Elements of dynamic complexity include: stock and flows, feedback processes, time delays, and nonlinear relationships (Senge, 1990).

System dynamics and Workforce Planning

The application of system dynamics dates back to early 60s and pioneering works of Forrester. Forrester (1962) used system dynamics to study the policies of labor source and control labor change. Sterman (2000) presented a system dynamics model in an educational setting. He divided professors in a university into three categories and modeled the promotion similar to a supply chain. He then proposed the concept of labor supply chain. Coyle (1996) investigated dynamics of balancing professionals in consulting firms. Winch (1999) used system dynamics to introduce a skill inventory model to manage the skills of key staff in times of change. Hafeez and Abdelmeguid (2003) developed a system dynamics model to help understand the dynamics of skill acquisition and retention. Hafeez et al. (2004) further used system dynamics as a tool to model and analyze the human resource planning problems in staff recruitment, staff surpluses and staff shortages. Homer (1984) analyzed the dynamics of repeated cycles of worker burnout and demonstrated the underlying psychology of 'Workaholism'. Wang (2005) used system dynamics to demonstrate the prospect of modeling technologies in a military setting. Bayer and Gann (2006) observed through their model the interactions between project portfolio and business-level processes and their influence on workload fluctuations. Koshio and Akiyam (2008) used a dynamic model to examine human resource crisis in Japanese hospitals. Warren (1998) centered his analysis on the dynamics of human resource management and the broader implications on quality and firm reputation. Warren's model focused on the dynamics of human resource management. In most of these models, there are common structures that stock is people who are currently working and flows are hiring and quit. System dynamics models for supply chain management also have a possibility to provide some implications for human resource models (Cappelli, 2009). Since human resource management is actually supply and demand management of human resource. This paper build on Sterman (2000) supply chain model of human resource development and adds a burnout reinforcing feedback that increases the degree of dynamic complexity of the system structure.

Causal loop Diagram

Figure 1 shows a causal loop diagram of the problem. It schematically describes the fundamental feedback processes in the dynamics of workforce planning.

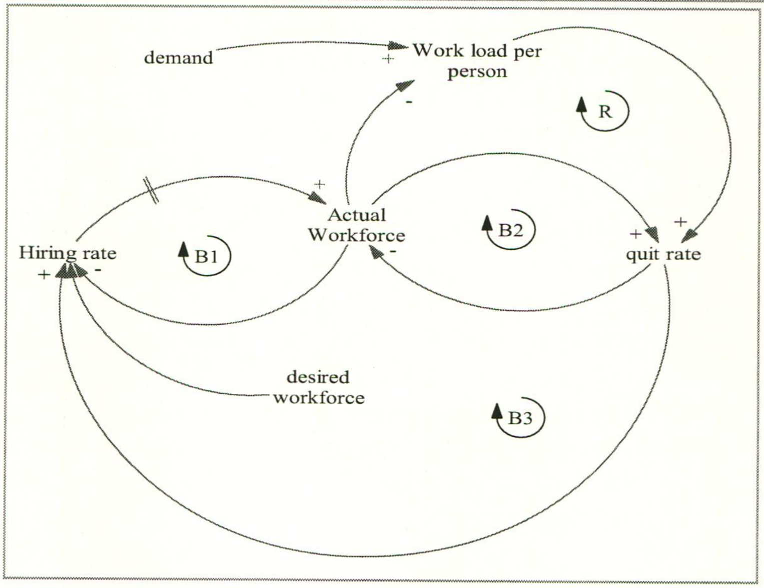


Figure 1. Feedback structure of workforce management

There are 3 balancing feedback loops, and 1 reinforcing feedback loop in this diagram. B1 is the balancing loop by which planners try to adjust the actual workforce with desired work force. If there is a gap between desired workforce and actual workforce, this loop tries to bring back the equilibrium. This loop contains a delay symbol that captures the time delays in this feedback process. It can be a physical delay involved between when a person is hired and its training before joining the professional workforce. It can as well be an information delay that captures the delay in information reporting subsystems. B2 is a balancing loop that corrects the steady state error of adjusting workforce based on actual workforce alone. It adds an average rate of quit to the hiring rate. B3 is the typical quit loop. It depends on actual workforce, and the average employment time. R1 is the reinforcing feedback loop that captures the nonlinear effect of increasing workload, responsibilities, and burnout of the workforce. A lower level workforce results in a more challenging work environment for the remaining staff. This leads to more staff leaving the company and lowering the workforce level further.

System dynamics model of the problem

Figure 2 shows the system dynamics model developed to address the problem. It is a stock and flow diagram that shows the important accumulations or stocks of the system together with their inflows and outflows.

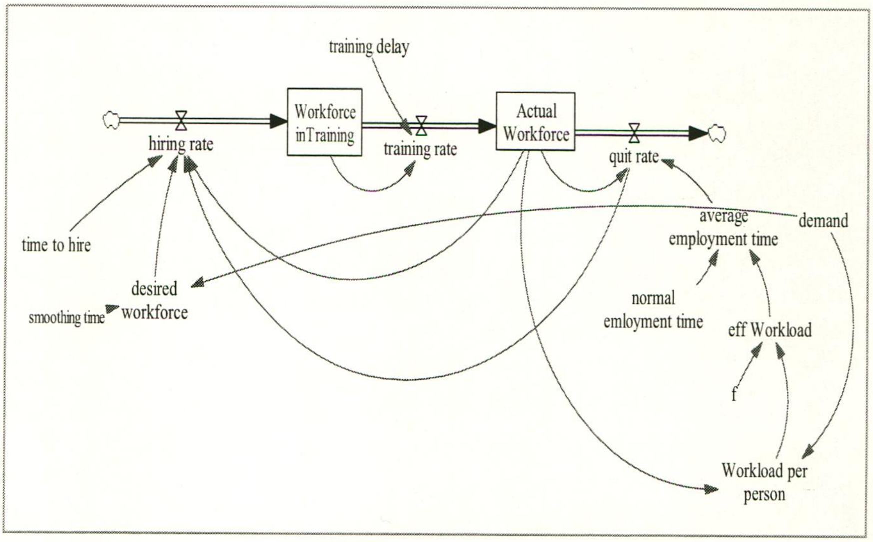


Figure 2. Basic Stock and Flow diagram of the model

The level of Workforce in Training stock is increased by hiring and decreased by training rate. The level of Actual Workforce is increased by training rate and decreased by quit rate. These two stocks accumulate the differences between their flows and add it to their previous value. Hiring rate is determined by the goal seeking rule which tries to correct any discrepancies between actual workforce and desired workforce. Its equation depends on the gap or discrepancy between actual workforce and desired workforce and a constant which captures the difficulty of hiring. It actually reflects the job market situation. Higher values reflect a tough job market and a lower number shows a market which managers find it easy to hire staff. Desired Workforce is smoothed function of demand which captures the information and reporting delays that are involved in the perception of the decision makers. Training rate is determined by the level of Workforce in Training and training delay. Quit rate is determined by the Actual Workforce and Average Employment Time. In normal conditions, the Average Employment Time is constant. However, tough working conditions and high workload leads to nonlinear effects that decrease Average Employment Time sharply.

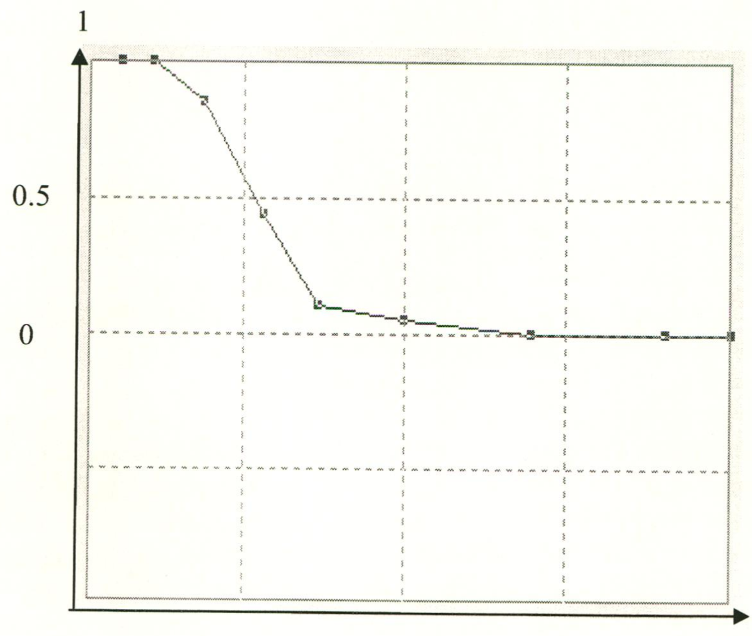
Below are the equation set of the model:

Workforce in Training = ∫(hiring rate –training rate).dt

Actual Workforce = ∫(training rate-quit rate).dt

hiring rate = (Desired Workforce - Actual Workforce) / time to hire

Desired Workforce = smooth(demand, smoothing time)
training rate = Workforce in Training / Training time
quit rate = Actual Workforce / average employment time
average employment time = normal employment time * effect of Workload per person on employment time
effect of workload per person on employment time = f(demand/Actual Workforce)
time to hire = 0.25 year
smoothing time=0.5 year
training delay=2 years
average employment time = 20 years
effect of Workload per Person on employment time=



time step = 0.1 year
Final time = 100 years
Actual Workforce(0)=100 persons
Workforce in Training (0)=10 persons

Simulation and Scenario Analysis

First, we start the model in dynamic equilibrium. In equilibrium, all flows in and out of all the stocks are equal. Therefore, the levels of stocks remain constant.

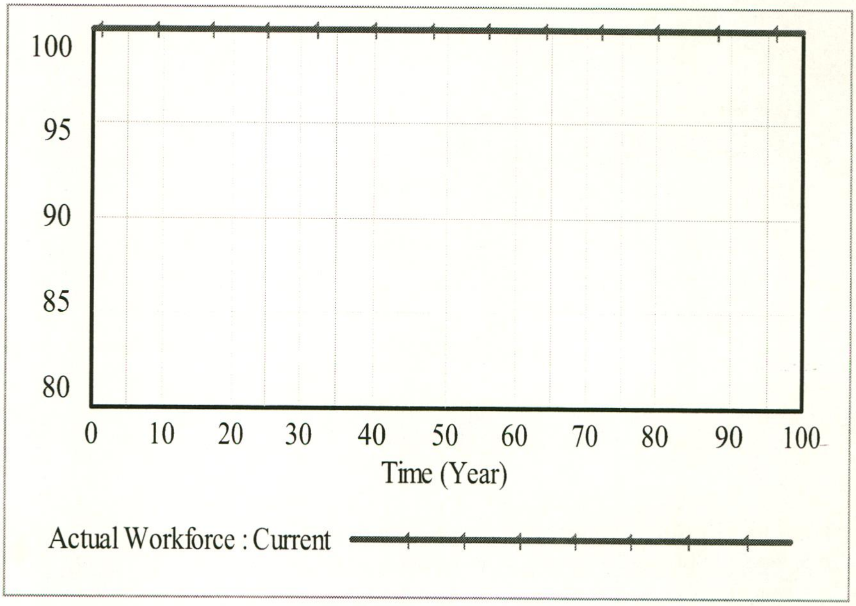


Figure 3: System in dynamic equilibrium

Now we implement a scenario that demand jumps 20% more from year 20. Figure 4 shows the response of the system to a step increase in demand. The system starts in dynamic equilibrium, but from year 20, the increase in demand causes instability in the system. This figure shows a long period of instability and oscillation in actual workforce and Workforce in training. This instability is costly and prevents the organization from providing sustainable high quality services.

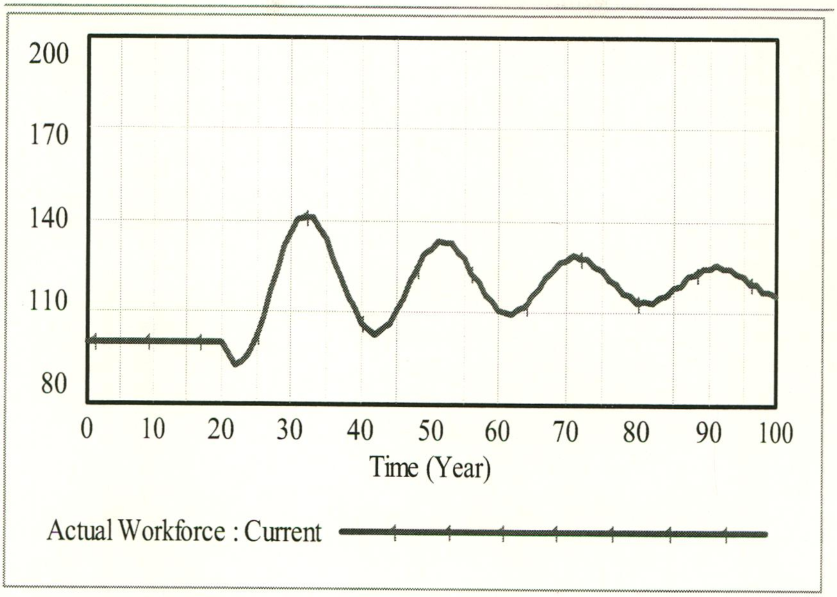


Figure 4: Response of the system to a 20% increase in demand

The instability becomes more severe with increasing the time delay needed to train new hires. Figure 5 shows the response of the system to a step increase in demand with an increase in training delay from 2 to 6 years. This situation is typical for highly skilled workforce in organizations such as hospitals.

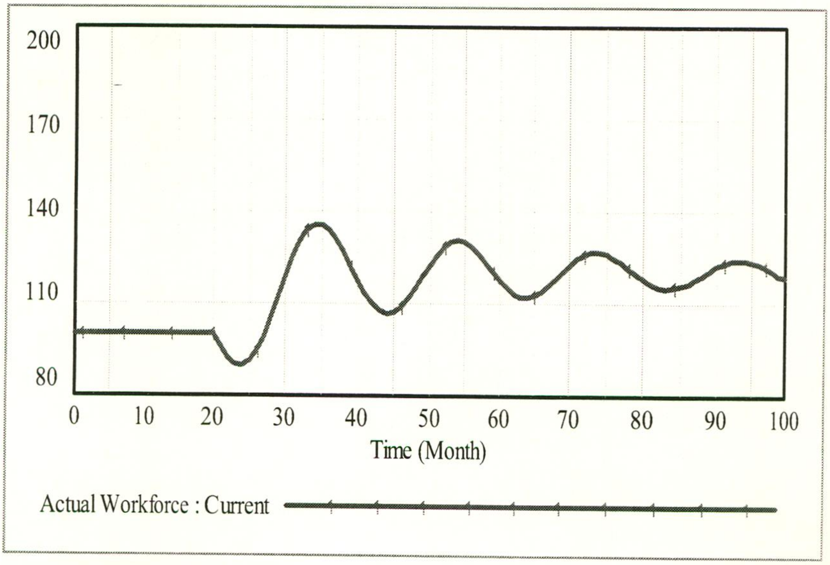


Figure 5: Response of the system to step increase in demand with a higher training delay

An easy job market allows managers to aggressively try to compensate the shortages of Actual Workforce,. But Decision makers, due to their bounded rationality, usually ignore the delay in the stock and flow structures. Figure 6 shows how this aggressive strategy leads to more instability.

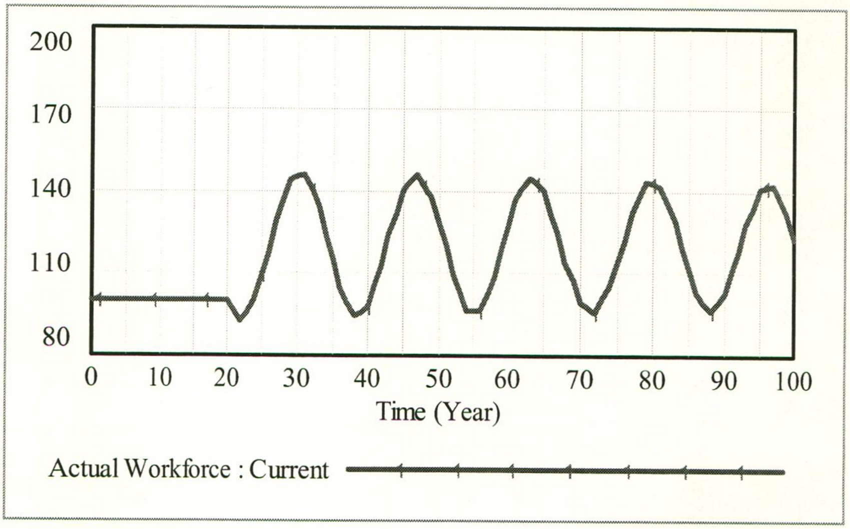


Figure 6: Response of the system to a step increase in demand with a smaller time to hire

If managers try to lesson the nonlinear effect of burnout, the instability is reduced. Figure 7 shows the response of the system to a step increase in demand where burnout has a weaker effect on quit rate.

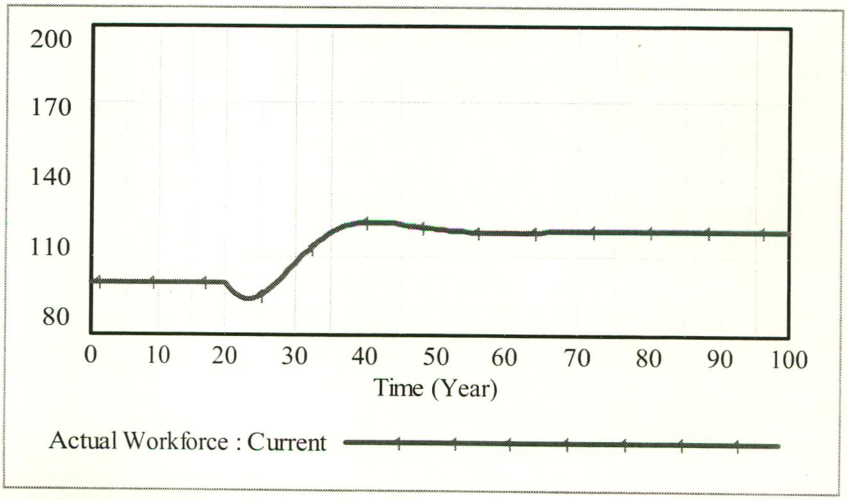


Figure 7: Response of the system to a step increase in demand with a weaker nonlinear effect

Reducing smoothing time has a dampening effect on the instability and oscillation of the system. Figure 8 shows the response of the system to a step increase in demand while smoothing time reduced from 0.5 to 0.1 years.

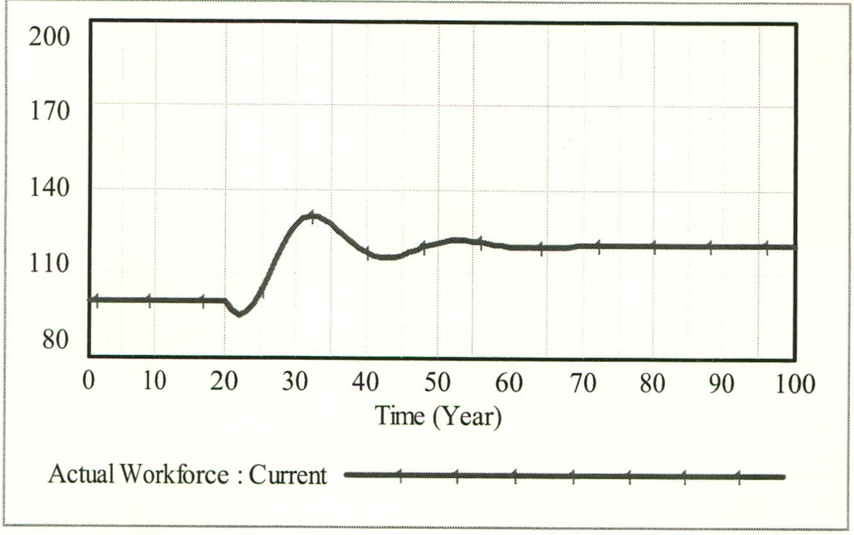


Figure 8: Response of the system to a step increase in demand with a shorter smoothing time

Conclusion

The simulation results show the effect of environmental changes and management strategies on the dynamics of hiring and quit of the Workforce. These changes result in a change in the equilibrium level of the Workforce. Two main conclusions can be drawn from the simulation results. First of all, in order to correct the shortage of Workforce problem, managers may make things worse, because of the dynamic complexity of the problem and bounded rationality of the decision makers. Therefore, managers should focus on the leverage points of the structure. Based on the simulation results, one of the leverage points is the number of desired Workforce. Correctly setting its value with regard to the time delays involved is a key strategy. Managers should change their perception of the required Workforce, and try to eliminate reporting delays that are involved in the process.

Second conclusion is about the reinforcing loop that causes people to leave the organization. Weakening this vicious loop has more leverage than trying to correct its effects. Using incentives and bonuses to dissuade people from leaving the organization is a strategy aimed at weakening this loop.

System dynamics is a useful tool that gives us a good understanding about the relationship between structure and behavior of systems. System structures with higher degrees of dynamic complexities can help design more effective strategies. In this paper I used only 4 feedback loops. This structure can be enriched by using other reinforcing loops such as the effect of productivity changes as a result of hiring inexperienced workers that leads to more frustration for the Workforce.

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