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SIMULATION MODELLING APPROACH TO HUMAN RESOURCES MANAGEMENT: BURNOUT EFFECT CASE STUDY

Marjana Merkač Skok[1], Jovana Zoroja[2,]* and Mirjana Pejić Bach[2]

[1]Faculty of Commercial and Business Sciences
Celje, Slovenia

[2]Department of Informatics, Faculty of Economics and Business – University of Zagreb
Zagreb, Croatia

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ABSTRACT

Human resources management has become one of the most important leverages in organizations for gaining competitive advantage. However, human resources management is in many occasions prone to nonlinear feedbacks with delayed effect. Burnout effect is one of the problems that are especially often faced by the experts in learning society. Burnout effect occurs because modern society is a fast-moving, achievement-oriented, very competitive and lead to many stressful situations, which individuals cannot handle always.

We propose usage of system dynamics methodology in exploration of burnout effect, and its usage in learning of consequences of burnout effect. Several experiments have been conducted and presented which indicate increase and collapse behaviour in case of burnout experience by the individual. Experiments with the model explore the presence of burnout effect in several different situations, with different pace of its manifestations.

KEY WORDS

burnout, system dynamics, employment, human resources

CLASSIFICATION

ACM: [I6] Simulation and modelling

JEL: C1, C8, J24, O15

*Corresponding author, η: jzoroja@efzg.hr; +385 (0)1 238 3276;
Faculty of Economics and Business, Trg J. F. Kennedyja 6, 10 000 Zagreb, Croatia

INTRODUCTION

Burnout effect affects individuals when they work hard and become exhausted, frustrated and unproductive. It is not just a problem of a lot of work but the attitude the person has towards its work and obligations [1, 2]. Burnout effect can also be described as a process of emotional exhaustion, depersonalisation and decreased personal accomplishment especially related to those who worked in human services [3, 4].

Psychological, medical and behaviour problems such as irritation, depression, violence, alcoholism, mental illness, heart disease and loss of appetite of over eating can be described to explain the burnout effect [5]. The source of burnout effect is trying to fulfil high expectations in a very short time period [1]. It has also implications for the organizational success [6].

There are some careers where burnout effect is more obviously such as teacher comparing with doctors, nurses and other who works in client-related professions [3, 7]. In order to avoid burnout effect individuals should relax, looking for help at work, defined limitations, find compromise for situations, gave realistic deadlines. There are also some strategies to prevent burnout effect such as: work less, minimize the stress and more relax [1, 5]. Also using simulation games and simulation models through learning process during educational seminars can be useful to prepare employees for stressful situations [8] which lead to burnout effect and can also teach them how to react in that situation.

Goal of the paper is to demonstrate the usage of system dynamics methodology in the exploration of the burnout effect. The model used is based on the assignment of MIT, named GSP-A27, where we propose usage of more simplified model in the class [9].

The paper is organized as follows. Introduction part is the first section. In the second section research methodology and analysis are presented. The model diagram is explained in the third section. Experiments with the model are described in the fourth section. At the end there is a conclusion and discussion part of the paper.

METHODOLOGY

System dynamics models are used in many different disciplines [10, 11] because they can give a very good overview of the structure and behaviour of the system using nonlinear links and feedback [12-14]. It is important that the approach to the development of the model is gradual in order to understand better the model behaviour [15-17]. In the next section, we propose gradual approach of exploration of system dynamics model which provide better understanding of the model.

MODEL

Model consists on two levels and three rates. It also contains four constant variables, and five auxiliary variables (Fig. 1). Effect of current health to health deterioration, and effect of current health on decrease in hours worked per day are presented in Fig. 2 and Fig. 3, respectively. Model equations are as follows:

Hours worked per day = INTEG (+ increase in hours –decrease in hours, 8),
Units: hours per day,
Number of hours that person works per day.

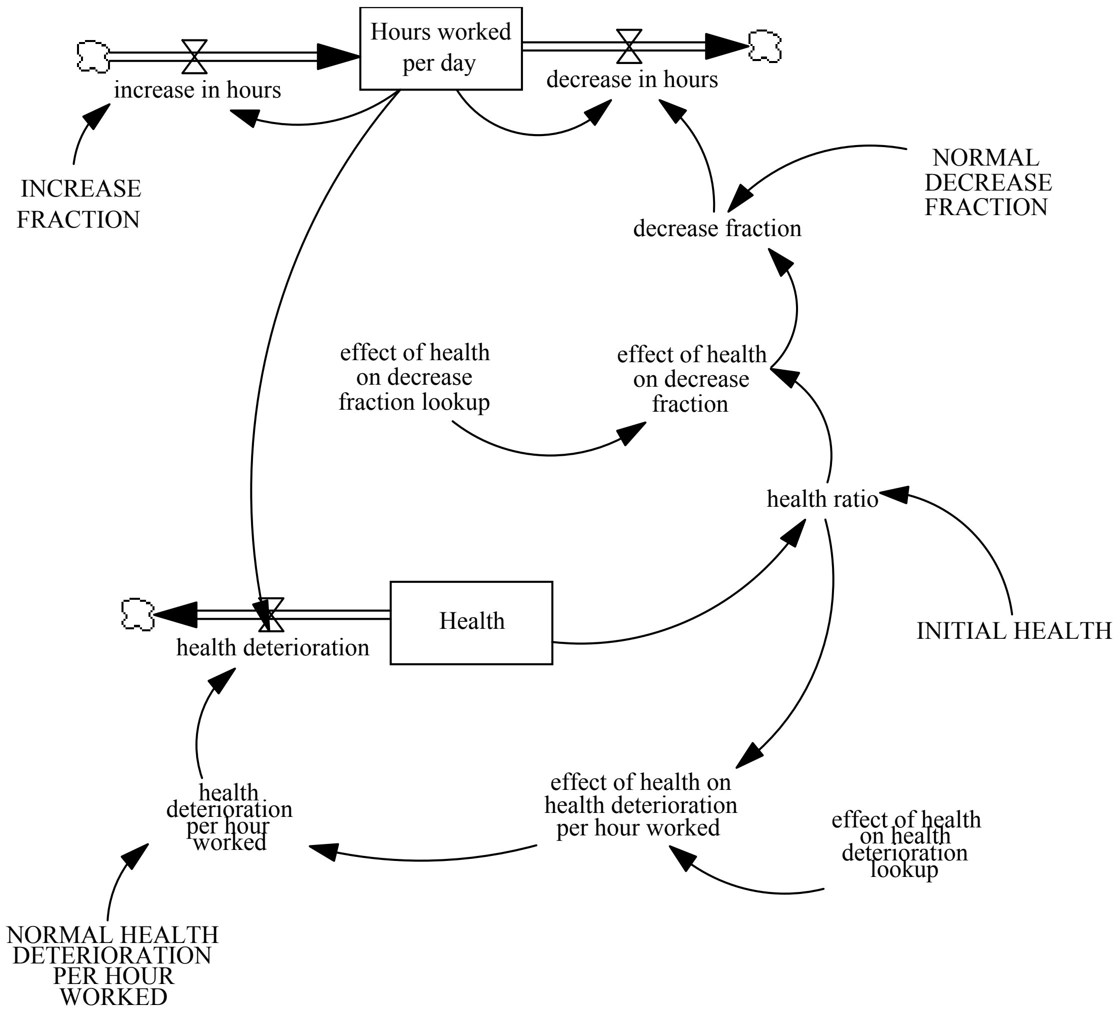

Figure 1. Model diagram.

Increase in hours = Hours worked per day ∗ INCREASE FRACTION,
Units: hours per day/Day,
The number of hours by which person daily increases the number of hours he/she works per day.

Decrease in hours = Hours worked per day ∗ DECREASE FRACTION,
Units: hours per day/Day,
The number of hours by which person daily decreases the number of hours he/she works per day.

Health = INTEG (–health deterioration, 100),
Units: units of health,
State of person's health. A perfect health is defined to have the value of 100, as in 100 %.

Health deterioration = Hours worked per day ∗ health deterioration per hour worked,
Units: units of health/Day,
Person's health gets worse as he/she works more.

Decrease fraction = NORMAL DECREASE FRACTION ∗ effect of health on decrease fraction,
Units: 1/Day,
The fraction of an hour by which person decreases the number of hours he/she works per day.

Effect of health on decrease fraction = effect of health on decrease fraction lookup (health ratio),
Units: dmnl,

The effect of person's health on the "decrease fraction". As his health deteriorates, person realizes that he/she has to stop working so many hours every day, so the "decreases fraction" grows (Fig. 2).

Effect of health on decrease fraction lookup ([(0, 0) -(1, 100)], (0, 100), (0.1, 100), (0.2, 100), (0.3, 100), (0.4, 50), (0.5, 26), (0.6, 10), (0.7, 2), (0.8, 1.2), (0.9, 1.05), (1, 1)),
Units: dmnl,
Lookup function for effect of health on decrease fraction.

Effect of health on health deterioration lookup ([(0, 0) - (1, 1)], (0,0), (0.1, 0.435), (0.2, 0.645), (0.3, 0.79), (0.4, 0.87), (0.5, 0.915), (0.6, 0.945), (0.7, 0.97), (0.8, 0.985), (0.9, 0.995), (1, 1)),
Units: dmnl,
Lookup function for the effect of health on health deterioration per hour worked.

Effect of health on health deterioration per hour worked=effect of health on health deterioration lookup(health ratio),
Units: dmnl,
The effect of person's health on the "health deterioration per hour". As person's health gets worse, the fraction of his/her health that deteriorates for every hour he works becomes smaller.

Health deterioration per hour worked = NORMAL HEALTH DETERIORATION PER HOUR WORKED ∗ effect of health on health deterioration per hour worked,
Units: (units of health/hours per day)/Day,
The fraction by which person's health deteriorates each day for every hour he/she works.

Health ratio = Health/INITIAL HEALTH,
Units: dmnl,
Ratio of current state of person's health and his/her initial health.

INCREASE FRACTION = 0,1,
Units: 1/Day,
The fraction by which person increases the number of hours he/she works each day. As person spends more hours working on the project, he/she likes it more and becomes more addicted to his/her work, so he/she spends even more hours working.

INITIAL HEALTH = 100,
Units: units of health,
The initial state of person's health. Assume person is initially perfectly healthy, so his/her health is at 100 %.

NORMAL DECREASE FRACTION = 0,05,
Units: 1/Day,
The fraction by which person decreases the number of hours he/she works each day while his/her health is perfect.

NORMAL HEALTH DETERIORATION PER HOUR WORKED = 0,15,
Units: units of health/(Day ∗ hours per day),
The fraction by which person health deteriorates with every hour he/she works.

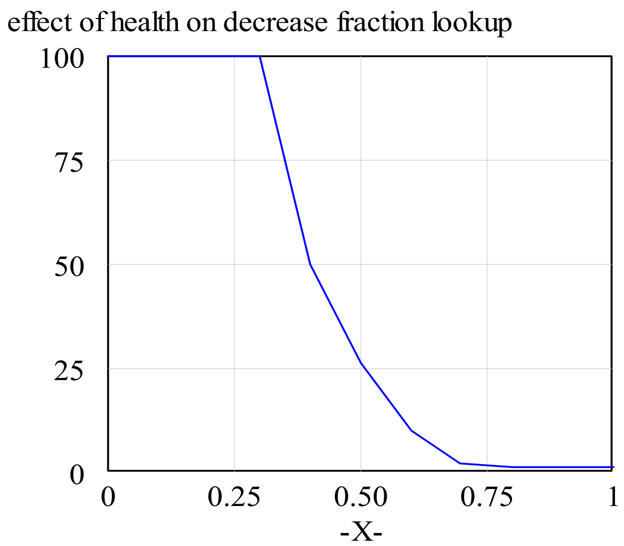

Figure 2. Lookup function for effect of health on decrease fraction.

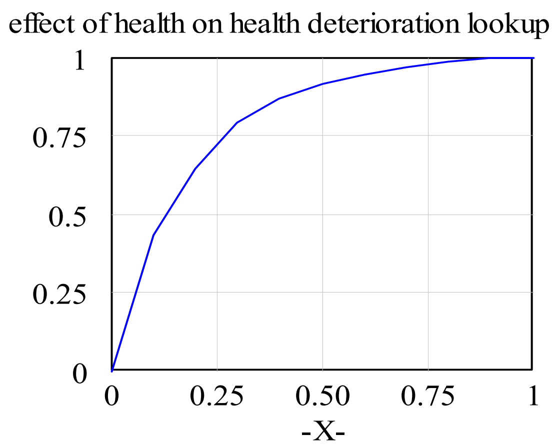

Figure 3. Lookup function for effect of health deterioration.

EXPERIMENTS WITH THE MODEL

BASE RUN RELATION BETWEEN HEALTH AND DECREASE OF HEALTH

In the model described in the "Generic Structures: Overshoot and Collapse" paper table function for the "effect of health on decrease fraction" is constructed according to the following assumptions. Fig. 4 presents behaviour of hours worked per day and health.

The lookup function for the "effect of health on decrease fraction" is a curve whose negative slope decreases in magnitude. The curve ranges from 0 to 1 for the "health ratio" which is the ratio of "Health" to INITIAL HEALTH, and from 1 to 100 for the "effect of health on decrease fraction". For higher values of "health ratio" table function outputs values close to 1, and for lower values of "health ratio" table function outputs values close to 0.

The "effect of health on decrease fraction" table function has a negative slope that decreases in magnitude. When fraction of "Health" remaining is still high, the depletion of "Health" will not have strong impact on "decrease fraction". As "Health" decreases, impact of depletion of "Health" is stronger. Also, when "Health" is equal to INITIAL HEALTH ("health ratio" is 1), "decrease fraction" is equal to NORMAL DECREASE FRACTION, and the table outputs a value of 1. As the fraction of "Health" remaining decreases, table output values higher than 1 and "decrease fraction" is higher than NORMAL DECREASE FRACTION.

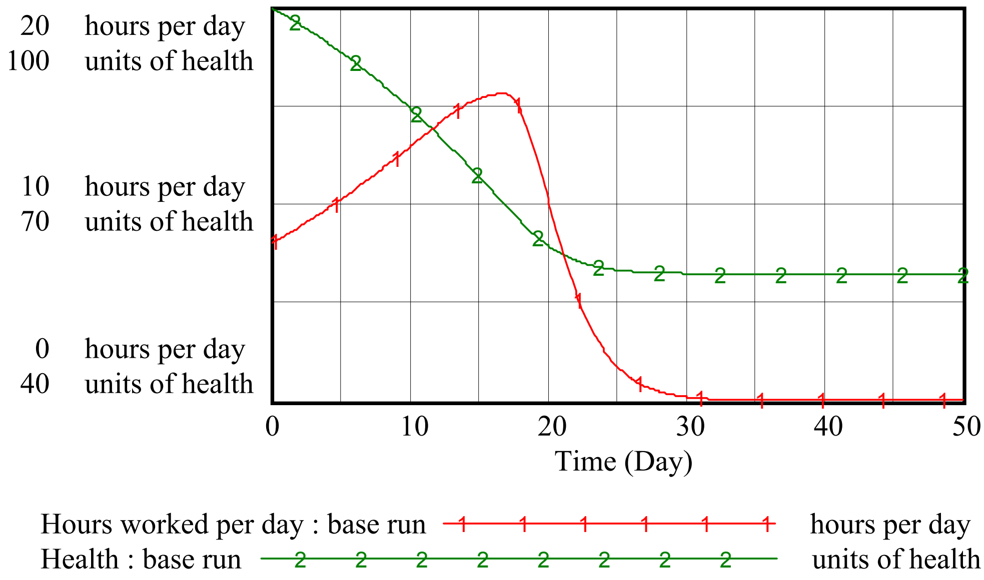

Figure 4. Behaviour of hours worked per day and health (base run).

In the base run, when table function is formulated according to the above description model exhibits overshoot and collapse behaviour. "Hours worked per day" reaches maximum value of 15,60 hours at 17th simulation day, and "Health" is depleted after 30 days and it decreases from initial value of 100 % to 59,36 %.

We wanted to see what will happen if table function is constructed under different assumptions [17]. We have simulated the model behaviour under following scenarios: (i) relation between health and decrease of health is linear, (ii) relation between health and decrease of health is less elastic than the base run, and (iii) relation between health and decrease of health is more elastic than the base run.

LINEAR RELATION BETWEEN HEALTH AND DECREASE OF HEALTH

Linear relation between health and decrease of health is represented by the lookup function represented at Fig. 5. Table function has again decreasing slope, but which is equal for the entire range of input values. Therefore, an increase in the "health ratio" for the one unit causes the decrease in the "effect of health on decrease fraction" for the one unit. Besides of that, table function is constructed according to the same assumptions as under base run.

Again, model behaviour has remain unchanged, and model exhibits overshoot and collapse behaviour (Fig. 6). "Hours worked per day" reaches maximum value of 8,56 hours at 1st simulation day, and "Health" deteriorates to the level of 91,90 % from initial value of 100 %.

LESS ELASTIC RELATION BETWEEN HEALTH AND DECREASE OF HEALTH (DECREASE SLOWER)

Less elastic relation between health and decrease of health compared to the base run is represented with Fig. 7. Table function for the "effect of health on decrease fraction" is constructed under same assumptions as in the base run, but maximum value for the table function is lower and is set to 10 instead to 100. Therefore, the "decrease fraction" becomes 10 times larger than NORMAL DECREASE FRACTION.

Model still exhibits overshoot and collapse behaviour. Number of "Hours worked per day" decreases slower than in the base run, and it reaches maximum value of 16,98 hours at 20th simulation day (Fig. 8). After 50 days "Health" decreases from initial value of 100 % to 34,59 %.

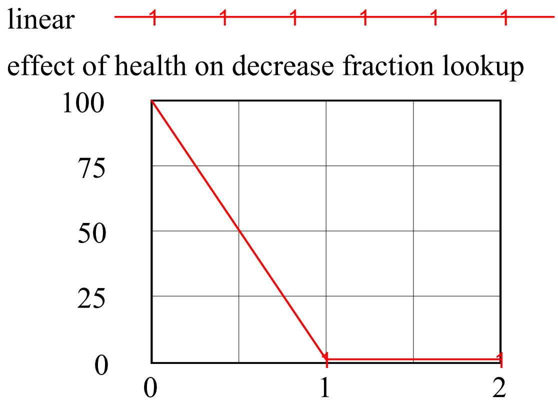

Figure 5. Lookup function for linear effect of health on decrease fraction.

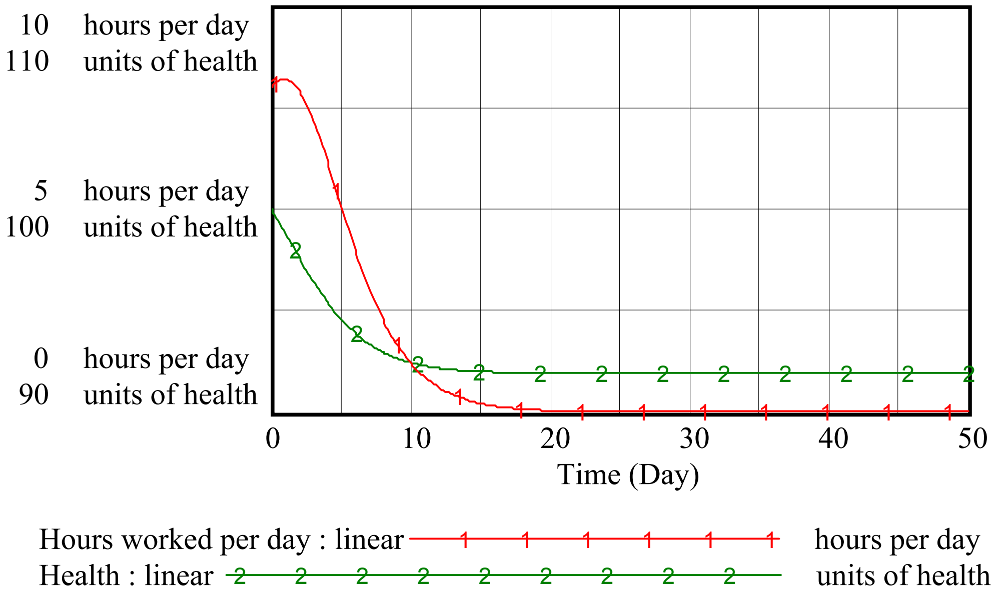

Figure 6. Behaviour of hours worked per day and health (function is linear and has negative slope).

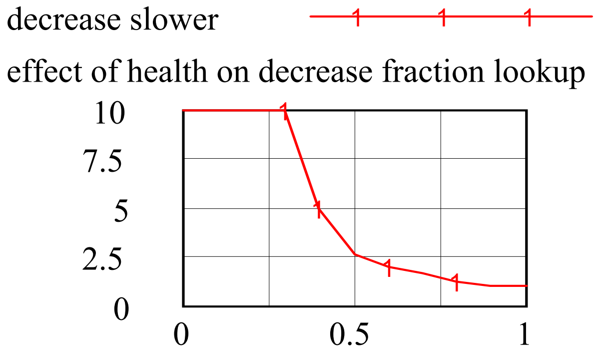

Figure 7. Lookup function for effect of health on decrease fraction (less elastic relation between health and decrease of health).

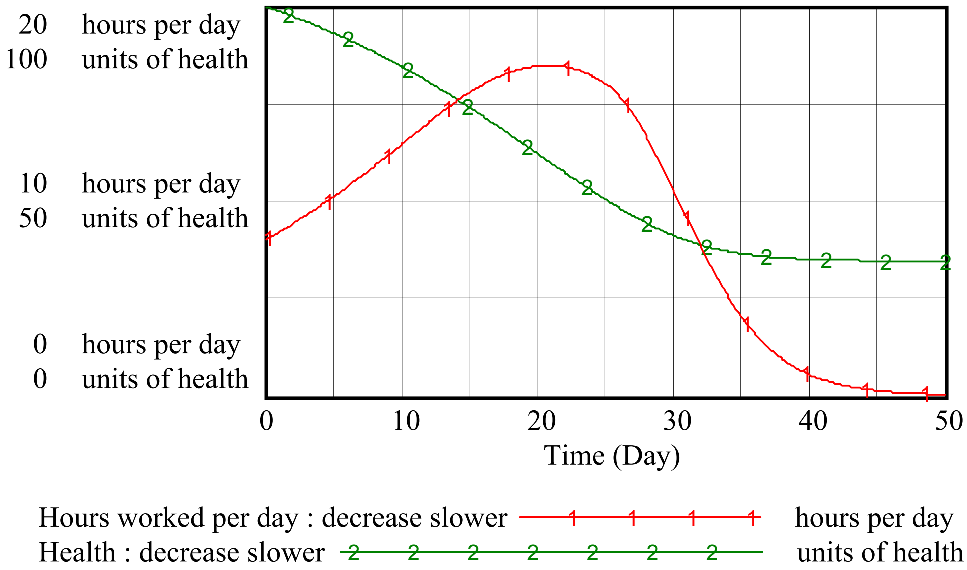

Figure 8. Behaviour of hours worked per day and health (less elastic relation between health and decrease of health).

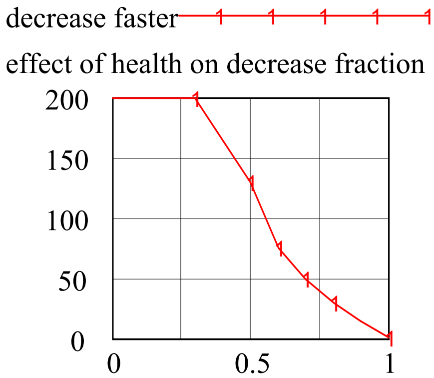

Figure 9. Lookup function for effect of health on decrease fraction (function is steeper than in the base run).

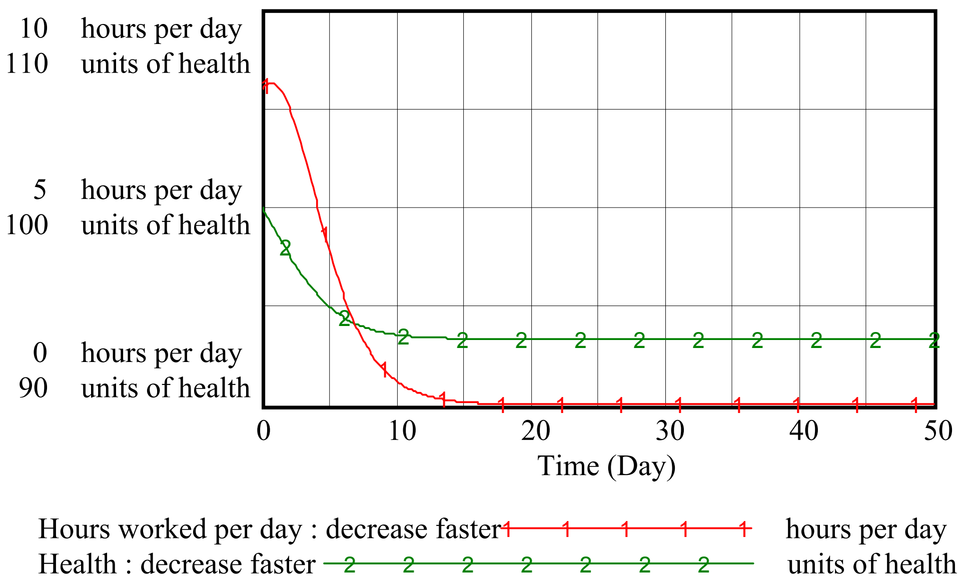

Figure 10. Behaviour of hours worked per day and health (function is steeper than in the base run).

MORE ELASTIC RELATION BETWEEN HEALTH AND DECREASE OF HEALTH (DECREASE FASTER)

More elastic relation between health and decrease of health compared to the base run is represented with Fig. 9. Table function for the "effect of health on decrease fraction" is again constructed under same assumptions as in the base run, but maximum value for the table function is higher and is set to 200 instead to 100. Therefore, the "decrease fraction" becomes 200 times larger than NORMAL DECREASE FRACTION.

Model still exhibits overshoot and collapse behaviour. Number of "Hours worked per day" decreases faster than in the base run and it reaches maximum value of 8,42 hours at 1st simulation day (Fig. 10). After 15 days "Health" decreases from initial value of 100 % to 93,33 %.

DISCUSSION AND CONCLUSION

We have constructed several table functions for "effect of health on decrease fraction" and for each specification we have simulated the model. Table 1 contains the summary.

Although model exhibits overshoot and collapse behaviour for every one of table functions, there are important differences between simulation runs. When table function was steeper than in the base run and when it was linear model shows unrealistic behaviour because number of "Hours worked per day" reaches maximum value in only one day and it is just a little bit higher than initial. Also, "Health" decreases for less than 10 %.

Model exhibits overshoot and collapse behaviour, but to such a small magnitude that it could be ignored because it is not realistic [14]. When table function was flatter than in the base run, number of "Hours worked per day" reaches maximum value later than in the base run, but model behaviour is still realistic. Graphs of the model behaviour confirm the conclusions (Fig. 11 and Fig. 12).

Individuals are affected by the burnout effect in situations when they work too hard and become exhausted, frustrated and unproductive. Behaviour of burnout effect has been explored by the usage of system dynamics approach. We have demonstrated presence of burnout effect in several different situations presenting different effects of health on decrease fraction. Based on our simulation results, it is obvious that the same pattern of behaviour emerges for the different values of effect of health on decrease fraction. However, that effect is stronger when the relation between health and decrease fraction in more elastic. In other words, burnout effect is more likely to emerge faster in situations when individuals have some initial health problems, thus producing reinforcing behaviour. In future studies we plan

Table 1. Results of the simulation for different table function specifications for "effect of health on decrease fraction".

Scenario	Maximum value for "Hours worked per day", hour	Time at which "Hours worked per day" reaches maximum value	Equilibrium level for "Health", %
Table function has positive and decreasing slope	15,60	17th day	59,36
Table function is linear with negative slope	8,56	1st day	91,90
Table function is flatter	16,98	20th day	34,59
Table function is steeper	8,42	1st day	93,33

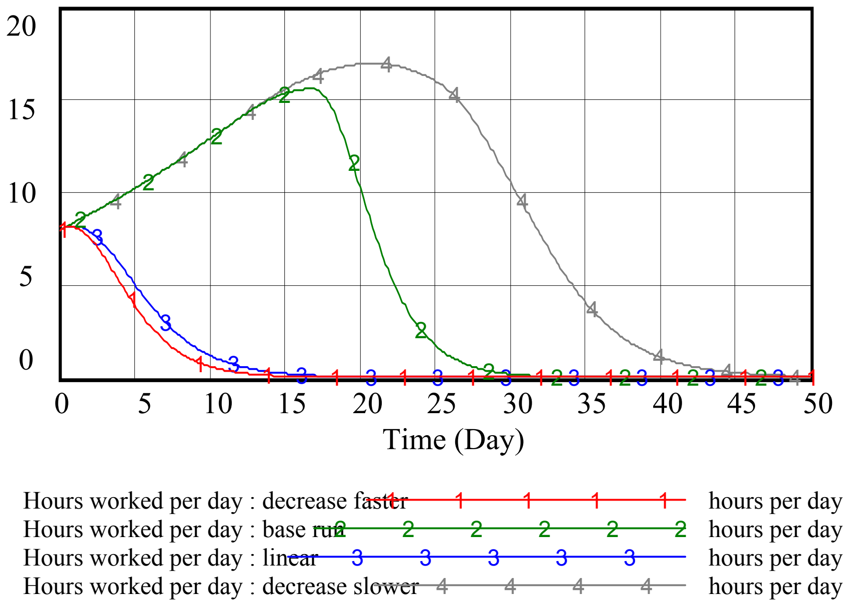

Figure 11. Lookup function for effect of health on decrease fraction (function is steeper than in the base run).

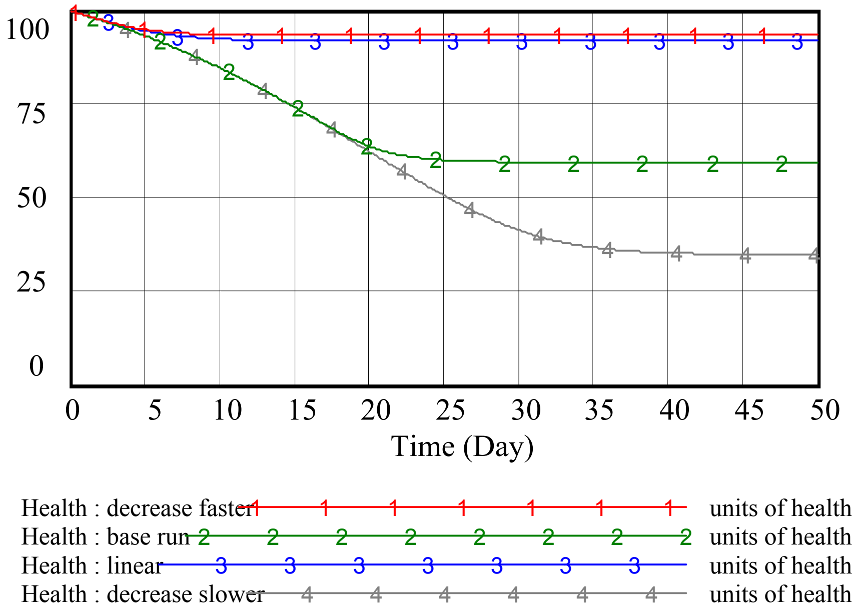

Figure 12. Graph for health (50 days).

to construct simulation learning environment that could enhance learning experience of human resources management experts.

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SIMULACIJSKI PRISTUP UPRAVLJANJU LJUDSKIM RESURSIMA: STUDIJA SLUČAJA EFEKTA IZGARANJA

M. Merkač Skok[1], J. Zoroja[2] i M. Pejić Bach[2]

[1]Fakultet za komercijalne i poslovne znanosti
Celje, Slovenija

[2]Katedra za informatiku, Ekonomski fakultet – Sveučilište u Zagrebu
Zagreb, Hrvatska

SAŽETAK

Upravljanje ljudskim resursima predstavlja jednu od najvažnijih organizacijskih jedinica za ostvarivanje konkurentske prednosti. Međutim, upravljanje ljudskim resursima u većini slučajeva ovisi o nelinearnoj povratnoj vezi s efektom kašnjenja. "Efekt izgaranja" predstavlja jedan od problema s kojima se često susreću eksperti u društvu znanja. "Efekt izgaranja" se događa zbog brzine života u modernom društvu koje je orijentirano pretežito ostvarivanju uspjeha, koje je izrazito konkurentno i natjecateljsko što vodi mnogim stresnim situacijama, s kojima se pojedinci ne mogu uvijek nositi.

U članku predlažemo korištenje metode sistemske dinamike s ciljem istraživanja "efekta izgaranja" i boljeg razumijevanja njegovih posljedica. Provedeno je nekoliko eksperimenata te su prikazani rezultati koji upućuju na različit način ponašanja pojedinaca prilikom "efekta izgaranja". Eksperimenti i model istražuju postojanje "efekta izgaranja" u nekoliko različitih situacija, koje predstavljaju različite brzine njegove manifestacije.

KLJUČNE RIJEČI

efekt izgaranja, sistemska dinamika, zapošljavanje, ljudski resursi