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Analysis of Company Human Capital Network Based on the Cellular Automation

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Abstract

In the age of knowledge economy, human resource is among the most important resources for enterprises, in that it forms the unique value of human resources which plays an indispensable role in the production and operating activities. Well managed human resources can effectively promote efficiency and thus create more social values. Therefore, it has aroused wide attention in academia. The thesis first establish the human capital value model and the human cost value model, based on which the thesis established the basic framework of enterprise human capital network. Then, simulation calculation from three aspects of human resource network were carried out with the cellular automation model. Firstly, we simulated the dynamic process of the change of personnel and got the evaluation model of the human cost in the future two years of a company, which can provide reference for company cost control. Secondly, the simulation mainly focused on checking whether under high staff churn rate, a company can still maintain certain number of employees. Thirdly, we simulated the healthy status of the human resource network under certain situations. Finally, We concluded that higher staff churn rate can lead to higher vacancy rate, which will lower the efficiency of companies .The thesis also explored with the model sensitivity analysis the benefit effect over human resource network by increasing recruits, indicating that increasing recruits can decrease the vacancy rate and improve the health status of the human capital network and based on the reality, we put forward the improvement direction of the model in indicator system aspect.

Keywords: human capital network, cellular automation, staff churn rate, cost of human capital

1. Introduction

With the mainstream of knowledge economy, human resource has increasingly become an important strategic capital in company management. Human capital means the labor's accumulation of knowledge and skills acquired by education, training, practical experiences knowledge transfer and health care. Human capital is the intangible assets of a company and is closely connected with organization effectiveness and the profit making as well. Companies are the main carrier and owner of human capital, thus how to effectively manage the human capital becomes a crucial part in competitiveness. When managing the human capital, we may notice an important phenomenon that the human capital is actually flowing. The flow of human means the change of human capital in space and position. On one hand, it can promote the flow of production factors and maximize the social value and self-value of human resources. On the other hand, it may cause instability in management, which may further decrease efficiency. Therefore, it's of great significance to study the flow of human capital. In the meanwhile, given that there exists human capital network, it would be an effective and creative way to research with network model.

At the present time, there have been studies of different degree both at home and abroad on enterprise human capital network. For instance, Jianhai Yin (2008), focusing on the monetization difficulty, put forward the ANP method to comprehensively evaluate the investment project of human capital. Xiufen Li and Ping Zhang (2012), by using BP neural network algorithm, established an evaluation model with four first grade indexes and sixteen second grade indexes. However, all of them simple studied from only one single aspect without overall analysis, and ignored the dynamic changing process of the network. Lepak and Snell (2009) draw on the resource-based view of the firm, human capital theory, and transaction cost economics to develop a human resource architecture of four different employment modes: internal development, acquisition, contracting, and alliance and use this

architecture to derive research questions for studying the relationships among employment modes, employment relationships, human resource configurations, and criteria for competitive advantage. Meizhong Zhao and Jiaming Zhu (2015), by using the method of distribution analysis and fuzzy comprehensive evaluation, established the computing model of the value of human capital, the euclidean distance fuzzy synthetic evaluation model and the sensitivity analysis model of the value of human capital, then based on the close degree figures and the software Pajek the researchers set up the network structure diagrams, and finally figured out the seven core factors impacting on the human capital value. But the research did not carry out dynamic analysis perfectly, and still failed in substantially explaining what impact will be caused by brain drains on company organization. While Yang Zhang and Yao Duan (2015) tried to speculate and analyze the enterprise human capital with layered complex network model. Based on bayesian network, markov model and the monte carlo simulation model, they simulated the dynamic process of the brain drain effect, yet still they failed to fully analyze the impact on the profit and the production force.

Brain drain or change of personnel will cause instability in company operation and management, which will preclude the company from keeping a stable number of employees, and further harm the efficiency, waste the human resources. In the meanwhile, brain drain will increase the recruit cost and leave a human resource network breach. Therefore, in the thesis, our attention focused on the impact of the change of on the human capital network, we then constructed the human capital network, and on account of the change factors, we tried to recognize the employees with a tendency to leave by using the Page Rank algorithm. The steps may well enable companies to prepare for the loss and stop in time the potential instability caused by job hopping. Furthermore, by using the cellular automation model, we simulated the stochastic process of the change of personnel of a certain company human capital network, which may probably provide references for company decision making.

2. The Value and Cost Model of Human Resources

To simplify the model, we make the following assumptions based on the reality during capital management.

1) Each employee can make value for the company which can be appropriately quantified. Employee can be considered as one of the indispensable production factors, and the profits are exclusively made by the employees. And we can quantify the values they made and further establish mathematical model.

2) Employees in different level of position create different amount of value for the company. The higher the level of position is, the more value is created. A higher position indicates a greater significance in a company as well as a higher cost, and accordingly more value is expected to be created.

3) More value will be created after staff training, and the staff, by accumulating experience, will gradually get more familiar with their work, which will improve efficiency and increase both the per capita and overall profits.

4) The higher the annual evaluation of an employee is, more value can be created. Performance appraisal (PA) is the direct criterion to evaluate an employee's performance. A higher score indicates a larger contribution.

5) The vacancy of a position will affect the integrity of production process, which means it will hinder the coordination and connection of information and work among neighboring positions, and further decrease the overall efficiency and profits.

6) The loyalty of an employee will influence the value he creates. Researched have shown that the stronger the sense of belonging becomes, the higher morale a certain employee will get. Under this case, the employee tends to create more values and profits.

2.1 Calculation of Value Created by Employees

The productivity of a corporation is closely correlated to each employee, thus the total value can be calculated from four aspects.

1) The level of position of an employee. The value an employee can create is positively correlated to his level of position. The greater the importance of the employee's position, the bigger the created value is. We define the value created by an employee as $\xi_i (i = 1, 2, 3 \ldots\ldots n)$. There are seven types of employees in the company, the value created by each type is ξ_1, ξ_2, $\xi_3 \ldots\ldots \xi_n (n = 7)$. And the value created by administrative clerk is ξ_1, And the value created by senior manager is ξ_7.

2) The seniority of an employee. More value can be created if the seniority of an employee is higher than other employees. As experienced employees have more training than others, attached value can be made, which is exponentially correlated to working age.

3) The score of annual evaluation. The performance of an employee can be evaluated as the score of annual

evaluation, which are currently not used by the HR office. The score of annual evaluation reflects if the knowledge and abilities of employees is maximized

4) Other factors. Other factors like the positivity and loyalty of an employee can also affect the creation of value.

Based on the analysis above, the total value created by staff is:

$$\xi_i = \sum \mu(\omega_i, \alpha) + \sum \beta^m - \lambda \quad (1)$$

$$\mu(\omega_i, \alpha) = \omega_i \times \alpha \qquad (i = 1, 2, 3 \ldots . 7) \quad (2)$$

$$\alpha = f(\sigma) \quad (3)$$

Where $\mu(\omega_i, \alpha)$ denotes the value created by employees in different level of positions, ω_i denotes the coefficient of employees in each level of position, α is a cardinal number for value calculation, which changes with the change of σ (the median income of the company), β^m represents the attached value created by working experience, m is the working age of an employee, and λ represents the change of created value caused by other factors like the positivity and loyalty of an employee etc.

The value of $\mu(\omega_i, \alpha)$ and ω_i in different level position is positively related to wage, it is shown in Tab 1.

Table 1. Value of the parameters in different level position

Level of Position	ω_i	$\mu(\omega_i, \alpha)$
Senior manager/Executive	8	8α
Junior manager/Executive	4	4α
Experienced supervisor	2	2α
Inexperienced supervisor	1.5	1.5α
Experienced employee	1	α
Inexperienced employee	0.9	0.9α
Administrative clerk	0.9	0.9α

Based on the assumption, in general cases, the employee with higher position or more experience will be of more importance in a company. Under this case, the employee may well create more values for the company. As the diagram shows, the senior manager values most, which is 8α. Next comes to the junior manager, and the human capital value of the experienced supervisor is higher than that of the inexperienced supervisor. In the meanwhile, as the position gets lower, the value indexes decrease as well.

2.2 The Cost of Human Capital Management

The cost of human capital management weighs a lot in the expenditures of a company. Thus minimizing the cost in human capital management is essential to increasing productivity. In this paper, the cost of human capital management involves three aspects:

1) **Recruitment** The cost of recruitment varies with the level of positions of employees. The higher the level of position is, the more the cost is.

2) **Wage** The cost of wage is the sum of all employees.

3) **Training** To improve the skills of employees, there are regular trainings for employees every year. The cost of training also varies with the level of positions of employees. The higher the level of position is, the more the cost is.

As a result, the sum of cost in each level of position is:

$$\phi_i = x_i \times (u_i - \varepsilon_i) + (y_i + z_i) \times \varepsilon_i \qquad (i = 1, 2, 3 \ldots 7) \quad (4)$$

Where ϕ denotes the sum of cost of human capital management, the sum of cost in each level of position is $\phi_1, \phi_2, \phi_3 \ldots . \phi_7$, the sum of cost of recruitment in each level of position is x_i , the sum of cost of wage in each level of position is y_i , z_i is the sum of cost of training in each level of position, u_i represents the number of positions in each level, and ε_i is the number of employee in each level.

So the sum of cost in human capital management is:

$$\phi = \sum_{i=1}^{n} \phi_i \quad (n = 7) \quad (5)$$

By subtracting the cost from the value created by all employees, the return of human capital can be calculated.

3. Cellular Automation Based on Human Capital Network

Within the company, given the need of information exchange and work coordination, employees of different position share certain connection with one another, the closer the positions are, the closer their connection will be. Every employee in a company plays their roles and as they flow a closely connected human capital network is formed. The network will change as the flow of personnel, thus affecting the production process and efficiency.

Given that the internal structure in network is complex and random, researchers establish models based on data in real life to study some important characteristics of internet. In this paper, human capital model is built to describe the interaction between divisions, and we use cellular automation to simulate different circumstances. As the structure of cellular automation is simply which enables high flexibility, thus it is appropriate for computer simulation.

3.1 Parameter Settings of the Simulation

1) Each cell in the cellular automation is equally treated. Every cellular corresponds to a position in a company, every position shares the same status, and there shouldn't exist such thing as discrimination of positions. Each cell only has two statuses. Accordingly, there exist only two representing situation for a position, "on the job" or "vacant". Then a position is filled with corresponding employee, the cell in the cellular automation is colored white. Otherwise, the color is blue which means the position is vacant.

2) Each cell is influenced by adjacent cells. The only reason for job vacancies is organization churn, other causes are neglected. And a job-hopping choice may influence the royalty of the employees' close friends in the company, namely the friends of the leaving employees have more tendency to hop their job and leave the position vacant.

3) The number of adjacent cells is essential to a cell. When there are three or less job hoppers are adjacent to a cell, the effect is not quite obvious. However, once the number of adjacent number of jobbers gets up to four, the effect will be significant. With more and more job hopping around a position, it's more possible for the person in this position to quit his or her job as well.

3.2 Results of the Simulation

The simulation results can be divided into four parts, first is the impact of personnel change on company human capital network. Second is the evaluation of the cost and value model of company human capital network. Third, under certain staff churn rate, the number of employees and the impact of personnel change on company human capital network. Forth, under several simulating situations, the health evaluation of the human capital network.

3.2.1 The Impact of the Personnel Change on the Human Capital Network

Every employee is possible to leave, and it's inevitable to lose part of the employees. To maintain the normal operation, the company must recruit certain ratio of employees. Given the different potential contribution of the old and new employees, and that it costs to recruit new members, recruiting will actually impact much on the human capital. Therefore, we need to simulate the personnel change situations in a company with cellular automation model, and further analyze its impact on the company human capital network.

Based on the analysis before, we assume that the initial probability of changing job for every employee is equal, and the value of probability is 0.0095. But the probability can be affected by adjacent cells. Meanwhile, the number of positions maintain stable, the number of employees who change job is approximately equal to the number of newly recruiting staff. Moreover, the reasons for organizational staff churn are promotion, quit and retirement. Others causes are not taken into account.

The cycle of cellular automation is one year, and we get the results of 10 times of simulation. The results are shown in Table 2.

Table 2. Results of 10 times of simulation

The time of simulation	1	2	3	4	5	6	7	8	9	10
The number of staff turnover	86	78	77	80	87	86	85	87	88	76
The staff churn rate (%)	23.2	21.1	20.8	21.6	23.5	23.2	23.0	23.5	23.8	20.5

According to Table 2, the total effect could be divided into two parts, the direct effect and the indirect effect.

On the perspective of the direct effect, since the number of positions remains unchanged, only when a position is vacant, the employees in lower level of position can get promotion. From this perspective, organizational churn can make more room for promoting efficient staff, which could increase the value of $\mu(\omega_i, \alpha)$, more value could be created in the corporation.

On the other hand, the vacancy of positions hind the information flowing in the network, the productivity will be reduced, the value of α will be smaller. At the same time, the cost of recruitment ϕ will be higher. What's more, as employees are trained each year, so the attached value of job hoppers will be missing, so the value of β^m will be significantly reduced. So the vacancy of positions will directly affect the value of human capital, and the productivity of a corporation will be reduced.

On perspective of the indirect effect, appropriate staff churn rate is beneficial for a corporation, which motivates employees to work harder. Nevertheless, a high staff churn rate will results the loss of talents. And the friendship and trust in an organization need to be reorganized, thus excellent corporation culture cannot be established in the long term, which will indirectly affect the efficiency of corporation's productivity.

3.2.2 The Evaluation of Cost of Both Recruitment and Training

To reach more profits, one good choice for companies is to control the cost, and the human resource remains a large part of the cost. A good control under most cases will bring more profits. The human resource cost mainly can be divided into several parts as the recruit cost, the training cost and the salary welfare cost, etc. And judging from the change of cost brought by change of personnel, we can conclude that the cost change mainly comes from the recruit cost and the training cost. Therefore, the thesis by using statistics from the simulation and the existing statistics, figured out the rough cost of the recruit cost and the training cost of a company in two years.

According to the rules of cellular automation for figuring out the influence of the change of human capital due to staff turn, the results of ten times of simulation are shown in Table 3.

Table 3. The results of ten times of simulation

The time of simulation	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
The number of new employee	129	128	112	119	128	117	109	125	111	135

The median of the number of newly recruiting employees can be calculated according to data in Tab.3.

$$N_{come} = \frac{(119 + 125)}{2} = 122 \tag{6}$$

Where N_{come} denotes the number of newly recruiting employees.

We assign 122 new employees to seven types of positions by the proportion of positions' number of each type. The cost of human capital management in each type of position is shown in Table 4.

Table 4. The cost of human capital management in each type of position

Level of position	1	2	3	4	5	6	7
The number of employees	3	7	8	8	36	50	10h
The cost of recruitment	3.6σ	4.9σ	4.8σ	4.8σ	10.8σ	5σ	3σ
The cost of training	1.5σ	4.2σ	1.6σ	2.4σ	3.6σ	15σ	0.5σ
Total cost	5.1σ	9.1σ	6.4σ	7.2σ	14.4σ	20σ	3.5σ

Meanwhile, the budget requirements for talent management for both recruiting and training over the next 2 years are all 65.7 σ. σ represents the median income of the corporation.

As can be seen from the table, the total cost of the position level 6 cost most, the main causes are firstly we have most recruiting members in this position, and secondly the training cost is the highest. Next comes to the position level 5, for it has the highest recruiting cost and at the same time the number of members in this position is only lower than that of the position level 6. The position with the lowest total cost is level 7, for it doesn't need much skills and has the lowest recruiting cost and training cost.

3.2.3 The Simulation of Staff Turnover with Given Churn Rate

The vacancy of a position will cause faultage in information exchanger and work coordination, or it will increase the burden of the positions around, all these may harm the efficiency of a company. Therefore, the manager of the company should maintain a certain number of employees and avoid too much vacancies. While we don't want it, job vacancy is actually a natural phenomenon in a company. While researches proves that when the vacancy rate has reached a certain level, the burden of the left employees will be forced to increase, and the efficiency will also be suffered. Therefore, the thesis tried to use the cellular automation model to simulate the personnel change situations, based on which the thesis further analyzed what the critical staff churn rate will be if the number of the remaining employees is going to reach an alarm line. And it may contribute as a reference for companies to manage itself better.

Based on the initialization, 370 cells in the cellular automation are designed as 10×37 grids. As 15 percent of positions are vacant, almost 55 positions are randomly colored blue.

To make sure 85 percent of positions are filled, so the number of employees who leave their positions is roughly equal to number of newly recruited staff. And the annual staff churn rate for all positions is 25%, thus the probability of changing job of a cell can be calculated.

$$p_l = (25\% - 15\%) * 370 / (315 * 12) = 0.0098 \tag{7}$$

$$p_l' = p_l * 10 = 0.0098 * 10 = 0.0980 \tag{8}$$

Where p_l is the probability of changing job of a cell in an ordinary way when a cell is affected by adjacent job hoppers, the cell's probability of changing job is p_l'.

As is mentioned in the question, the HR office is actively hiring about 8-10% of the company positions (about 2/3 of the current vacancies), thus the proportion of newly recruited staff p_c is:

$$p_c = 2/3/12 = 0.0556 \tag{9}$$

As almost 85% of the company's 370 positions are filled in most of the time, and cells are equally treated in automation. Thus in the process of cellular automata simulation, the number of employees who leave their positions is roughly equal to number of newly recruited staff in each iteration, and the updating rule of matrix is:

$$N_{vacant}' = N_{vacant} + N_{leave} - N_{come} \tag{10}$$

Where N_{vacant}' is the number of vacant positions after an iteration, N_{vacant} denotes the number of vacant positions before the iteration, N_{leave} is the number of employees who change jobs in this iteration, and is the number of newly recruited staff.

In this paper, the length of iteration cycle is defined as a month, so there are 12 iterations in one year. When 85 percent of position are filled with corresponding employee and the annual staff churn rate for all positions is almost 25%, the results of five times of simulations are shown in Table 5.

Table 5. The results of five times of simulations

Number of Cycle simulations1		*Cycle 2*	*Cycle 3*	*Cycle 4*	*Cycle 5*	*Cycle 6*	*Cycle 7*	*Cycle 8*	*Cycle 9*	*Cycle 10*	*Cycle 11*	*Cycle 12*	*Annual churn rate*
1	55	55	50	53	57	56	51	55	57	52	51	48	21.1%
2	55	53	56	56	57	53	50	53	53	52	50	43	22.7%
3	55	56	53	58	63	62	62	61	59	55	59	61	24.6%
4	55	55	49	50	50	42	43	42	45	40	45	47	22.7%
5	55	48	50	46	48	48	46	50	48	50	51	53	23.8%

As is shown in Table 5, when the annual staff churn rate for all positions is almost 25%, the vacancy rate of positions is about 15%. And in the third simulation, the annual staff churn rate is the most closet to 25%, and the biggest number of vacant positions in one year is 63, and the corresponding vacancy rate of positions is 17%, which is lower than 20%. And the vacancy rate of positions in other simulations is lower than 17%. And the scatter diagrams of first and second simulation are shown in Figure 1 and Figure 2.

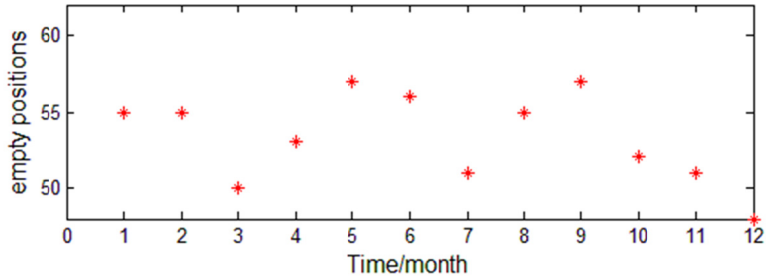

Figure 1. The scatter diagrams of first simulation

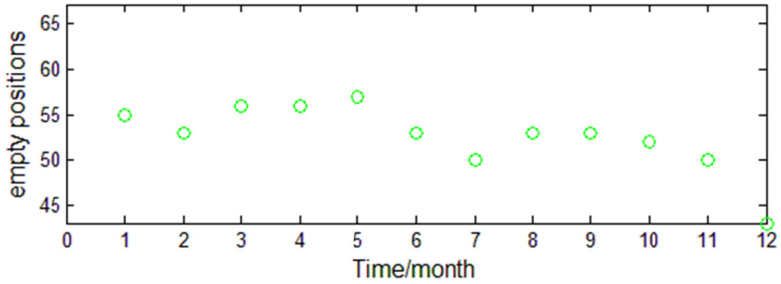

Figure 2. The scatter diagrams of second simulation

As is shown in Figure 1 and Figure 2, the annual staff churn rate is around 21%, and the number of empty positions in the company is around 55, thus the corresponding vacant rate of positions is almost 80%. So we can conclude that the company sustain its 80% full status for positions if the annual staff churn rate for all positions goes to 25%.

When the annual staff churn rate for all positions goes to 35%, we get final results by repeating the steps above, specific data are shown in Table 6.

Table 6. The results of five times of simulations

Number of simulations	*Cycle 1*	*Cycle 2*	*Cycle 3*	*Cycle 4*	*Cycle 5*	*Cycle 6*	*Cycle 7*	*Cycle 8*	*Cycle 9*	*Cycle 10*	*Cycle 11*	*Cycle 12*	*Annual churn rate*
1	55	55	56	57	62	65	69	75	77	77	81	82	*34.3%*
2	55	60	63	65	67	69	67	69	72	69	75	73	*33.3%*
3	55	54	65	68	67	64	68	70	71	83	88	86	*35.7%*
4	55	51	55	58	59	61	61	70	77	81	82	75	*33.5%*
5	55	55	62	65	66	69	68	70	71	72	74	81	*31.6%*

Meanwhile, the scatter diagram of data in Tab 6 is shown in Figure 3.

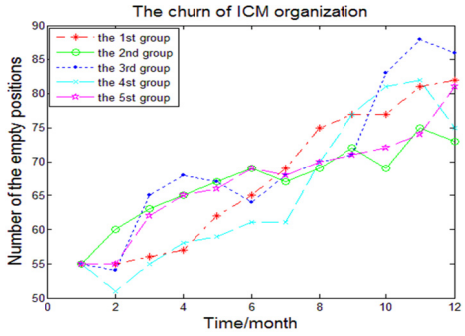

Figure 3. The results of five times of simulations

As is shown in Figure 3, when the annual staff churn rate for all positions is up to 35%, the vacancy rate of positions is fluctuating in earlier stage, but the comprehensive trend is upward, and the slope is positively correlated to the annual staff churn rate. The rate of vacant positions in five times of simulation are 22.2%, 22%, 23.8%, 22.2%, and 21.9%, they are all bigger than 20%. So we can conclude that the company can't sustain its 80% full status for positions if the annual staff churn rate for all positions goes to 35%.

From the results above, we acknowledge that the vacancy rate of positions is bigger than 20% when the annual staff churn rate for all positions is up to 35%. From the perspective of economic, the cost of recruiting will be much higher, and the value created by employees will be significantly reduced. What is more, when more information of organizational churn is emerging in the network, more employees will be affected by job hoppers, which will be a vicious circle. Then a solid team can't be established, let alone excellent corporation culture. To conclude, the cost of high turnover rate is so heavy that the company needs efficient management of human capital.

3.2.4 Simulation of the Healthy Situation of the Human Capital Network under Certain Cases

We recognize that middle managers (Junior Managers, Experienced Supervisors,) often feel stuck in their jobs with little opportunity to advance, causing them to leave the company when they find a comparable or better job. These mid-level positions are critical ones that unfortunately suffer high staff turnover (twice the average rate of the rest of the company) and seem to need filling all the time.

When researching the human capital network of a company, we need to evaluate its health situation from different aspects. Given that we cannot recruit new members all the time, so here we assume that there is no outer recruitment, and we only consider to promote inner employees. Under such situation when both the hopping rate of the junior and the experienced manager reach 30%, and the hopping rates of other positions keep at about 18%, we researched whether the health situation of the human capital network will be affected and figured out the simulated results with the cellular automation model.

When the staff churn rate of both junior managers and experienced supervisors is 30% while other staff churn rate remains 18%, if the company organization has no the external recruiting. By changing the rules in cellular automation, the result of the simulation is shown in Figure 4.

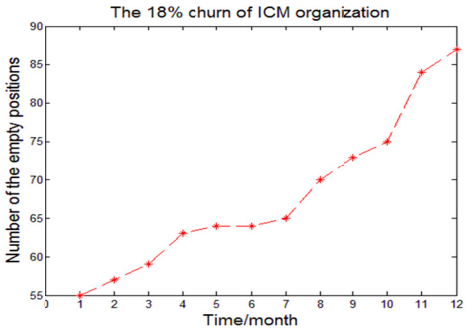

Figure 4. The results of simulation

As is shown in Figure 4, the number of vacant positions is increasing with a rising slope as time goes by. In this circumstance, the human capital of the corporation is caught in a vicious circle. As mid-level positions like junior managers and experienced supervisors are critical ones for the company, but the staff churn rate of mid-level positions is much higher than other positions. What's more, there is no external recruiting, so the problem of brain drain will be more serious. Nevertheless, it is a right choice to promote qualified employees. Only when the employees are qualified, the productivity can be enhanced.

3.3 Sensitivity Analysis of the Simulation

In the rule of cellular automation, the proportion of newly recruiting employees is two-third of the number of vacant positions. To effectively control the vacancy rate, we can research the connection between the recruit number and the vacancy rate. Therefore, we adjusted the rule indexes of the cellular automation model, increased the recruit number, thus carrying out simulation test to get the sensitivity results. Based on the results, we concluded that when the recruit number increases, the vacancy rate can be effectively reduced, and the human capital network can be improved.

When the turnover rate goes up to 35%, the number of vacant positions is increasing in the next two years, which reduces the efficiency of the corporation significantly. If the company decides to recruit more employees to reduce the number of vacant positions, so we adjust the value of the proportion of newly recruiting employees from 0.0556 to 0.0883, the results of simulation is shown in Figure 5.

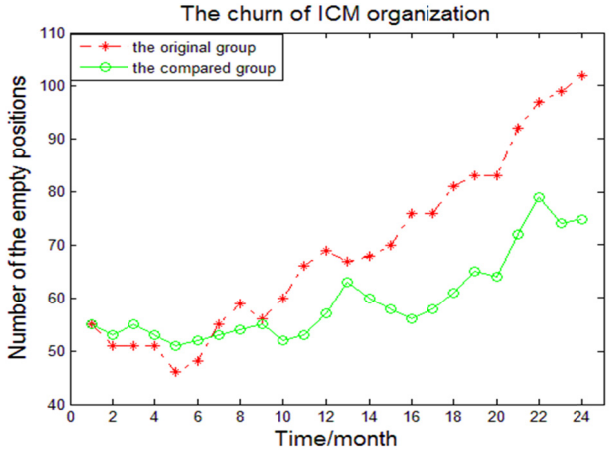

Figure 5. The results of simulation when more employees are recruited

As is shown in Figure 5, when more employees are recruited, the number of vacant positions is around 55 and recruiting more employees can actually decrease the numbers of vacant position. But in second year, the number of vacant positions is rising with an increasing slope. So the solution of recruiting more employees can't solve the problem essentially, the efficiency of the corporation will decrease significantly eventually.

4. Conclusion

The thesis mainly established the human capital model based on cellular automation. Specifically, we constructed the value and the cost model of the company human capital and set the model rule of the cellular automation based on the idea of the cellular automation model. Then we analyzed the impact of personnel change on the company human capital network by simulating the dynamic process of the company personnel change. Thus we acquired the final impact results. To provide better reference for companies to control the human cost, the thesis combined the simulated and the existing statistics and established an evaluation model of the human cost of a company in two years. Furthermore, the thesis, under the designated staff churn rate of 25% and 35%, simulated the case with the cellular automation, of which the results are that when the staff churn rate is 25%, the vacancy rate can be controlled within 20%. While when the staff churn rate is 35%, the vacancy rate fails to stay within 20%. The thesis, based on the above results, analyzed the impact of high personnel change on the company human capital network and simulated the health situation of the human capital network under certain cases by adjusting the rule of the cellular automation model. Finally, the thesis, by carrying out sensitivity analysis, explored the effect of increasing recruit number, and concluded it can decrease the vacancy rate and improve the health status of the human capital network. When evaluating the health situation of a company, the

thesis merely considered aspects such as the value of human capital, the human cost, and the efficiency of companies, etc. Therefore, in the follow-up study, attention can be focused on the construction of a comprehensive and systematic index evaluation system, which can further specify the evaluation results.

References

Brodka, P., Skibicki, K., Kazienko, P., & Musial, K. (2011). A degree centrality in multi-layered social network. *Computational Aspects of Social Networks (CASoN), 2011 International Conference on* (pp. 237-242). IEEE.

Johnson, S., Schnatterly, K., & Hill, A. D. (2014). Board composition beyond independence: Social capital, human capital, and demographics. *Journal of Management*, *39*(1), 232-262.

Lepak, D. P., & Snell, S. A. (1999). The human resource architecture: Toward a theory of human capital allocation and development. *Academy of Management Review*, *24*(1), 31-48.

Li, L. S. (2012). Research on Human Resource Allocation Based on Network Affecting the SMEs Innovation Performance. Jiangsu University.

Li, X. F., & Zhang, P. (2013). A Research on Value of Individual Human Capital of High-Tech Enterprises Based on the BP Neural Network Algorithm. *The 19th International Conference on Industrial Engineering and Engineering Management.* Springer Berlin Heidelberg.

Liu, J., Zhang, W. Z., Jin, D. P., Yuan, J., Zeng, L. G., & Wang, Y. X. (2010). Network model based on two-dimensional cellular automation. *Application Research of Computers*, *27*(2), 614-617.

Nyberg, A. J., Moliterno, T. P., Donald Hale, J., & Lepak, D. P. (2014). Resource-based perspectives on unit-level human capital: A review and integration. *Journal of Management, 40*(1), 316-346.

Nygreen, M. D. K. (2013). Educational new paternalism: Human capital, cultural capital, and the politics of equal opportunity. *Peabody Journal of Education*, *88*(1), 84-97.

Tata, J. (2015). Immigrant family businesses: Social capital, network benefits and business performance. *International Journal of Entrepreneurial Behaviour & Research*, *21*(6), 842-866.

Wang, X., & Fu, P. (2013). The evolution of human resource management based on cranet network and danger wavelet neural network. *Journal of Convergence Information Technology, 8*(6), 51-58.

Yin, J., H. (2010). Research on the evaluation of human capital investment of enterprise management personnel based on ANP. *Shandong Social Sciences*, *3*, 129-135.

Zhang, Y., Duan, Y., & Wang, C., Y. (2015). Research on human capital model based on hierarchical complex network. *Computer Knowledge and Technology*, *9*, 252-253.

Zhao, M. Z., Zhu, J. M., Li, Z., & Wang, X. (2015). Research on human capital value based on network model. *Journal of Langfang Teachers University (Social Sciences Edition)*, *2*, 74-77.

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