Journal of Applied Sciences

ISSN 1812-5654

science alert

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Journal of Applied Sciences 13 (24): 5804-5809, 2013
ISSN 1812-5654 / DOI: 10.3923/jas.2013.5804.5809

How to Improve the Transfer Efficiency of Tacit Knowledge among Organizations?

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Abstract: In the era of knowledge economy, knowledge plays an important role in firm development. How to improve the effect and efficiency of the knowledge transferring in order to strengthen the firm competition? In this study, the influence factors of transfer efficiency of tacit knowledge are analyzed with the differential dynamics model. The result suggests the hidden time determines the terminal state of the transferors' number. The number will be stable and constant when forget ratio and contact frequency are set and time delay belongs to (0, 1.73) while the number will have a Horf bifurcation and periodic variance when time delay belongs to (1.73, 2). In the former station, the transfer efficiency of tacit knowledge is positively related to contact frequency and effective contact among organizations while that is negatively related to forget ratio. These results will be beneficial to firm management and improve the transfer efficiency of tacit knowledge.

Key words: Tacit knowledge, differential dynamics, time delay, hofp bifurcation

INTRODUCTION

In the knowledge economy, the core of competition advantage is the knowledge what you have owned. In other words, the continuous competition advantage should be achieved by creating and owning the new knowledge (Drucker, 1998; Zhang and Wang, 2012). The knowledge can be classified into explicit knowledge and tacit knowledge. The former is the knowledge described by the written words, charts and tables and mathematical formula. On the other hand, the latter is included into the behavior and not be expressed explicitly (Polanyi, 1985).

As we all know that, explicit knowledge is transferred between two organizations easily, and tacit knowledge is the contrary. It is well known that tacit knowledge has played an important role during the course of firm competition advantage, and the cooperation is the main transferring way from the organization to another one. However, there are few literatures focusing on the transfer between two organizations and transfer efficiency. Therefore, this paper will construct the tacit knowledge model to analyze the transfer efficiency between two organizations.

There are different definitions about tacit knowledge (Sun, 2009) thought tacit knowledge is characteristic, informal and hard to communicate with others. Howell argued that tacit knowledge is non-coding achieved by informal study and procedures. Polanyi (1985) thought tacit knowledge can be described by the written words, charts and tables and mathematical formula and explicit knowledge is included into the behavior and not be expressed explicitly.

The tacit knowledge can be transferred through communicating among members in the same organization. Besides that can be transferred by formal visit, interview, communication and informal conversation among different organizations.

TACIT KNOWLEDGE MODEL

Conversion from transferor to learner in an organization: The tacit knowledge will be propagated when the organizations are cooperated and the members are communicated. The members communicate by the way of formal visit, interview, communication or other informal ways. In order to simplify the analysis, two organizations are included and some members in organization 1 have the tacit knowledge initially, i.e., the transferor and the members in organization 2 have no tacit knowledge initially, i.e. the learner. It is well known that the tacit knowledge will be transferred in the course of organizations cooperation. However, it is not sure there is transfer in every communication. Therefore, the sufficient learn will be supposed.

Since, the learned knowledge will be forgot, the achievement of tacit knowledge is not perpetual which is called forget period. The original transferor will become the new learner and learn the tacit knowledge again when he or she forget these tacit knowledge. The conversion between the transferor and learner can showed in Fig. 1.

It is supposed there are the transferors and learners in organization 1. The learners in organization 2 can learn the tacit knowledge from the transferors in organization 1 and become the transferors when the communication is fully done between the two organizations. Since, the transfer is going on in the course of cooperation, the numbers of transferors and learners are supposed as the function of the time t. At the same time, the new

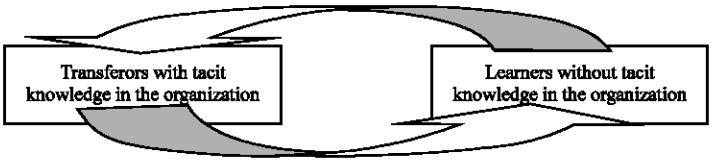

Fig. 1: Conversion of transferors and learners

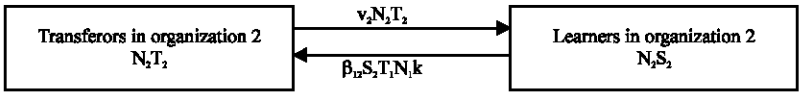

Fig. 2: Figure of tacit knowledge model

transferors in organization 2 would forget the tacit knowledge and become the new learners. So, the time delay will be analyzed.

Tacit knowledge model: It is assumed the member number in organization i is N_i. The number of members who have owned the tacit knowledge in organization i is the function of time t and $T_i(t)$ is the proportion of those and N_i. While the others who have no tacit knowledge is S_i (t) of the total members in organization i. $T_i(t)N_i$ and S_i (t)N_i could be continuous when the members in organization i are enough:

$$N_i (T_i+S_i) = N_i \quad (1)$$

It is assumed that all members have no tacit knowledge initially in organization 2, i.e., all members are learners:

$$N_2 S_2(0) = N_2 N_2 T_2(0) = 0 \quad (2)$$

Besides, the members are divided into tacit knowledge transferors and learners in organization 2 at the time t. In the coursing of cooperation between organization 1 and 2, not all members with tacit knowledge could take part in the cooperation, so it is supposed that k is the proportion of the attendee to the members with tacit knowledge. β_{12} is the contact number of tacit knowledge in organization 1 to others in organization 2 at the time t. Therefore, the increasing of knowledge transferors in organization 2 is $\beta_{12}S_2T_1N_1k$. The number of new learners for they forgot the tacit knowledge is $v_2N_2T_2$, there, v_2 is the proportion of transferors converting to new learners, called forget proportion at the time t. So, the actual increase of transferors in organization 2 at the time t could be depicted as the following equation:

$$(N_2T_2)' = \beta_{12}S_2T_1N_1k - v_2N_2T_2 \quad (3)$$

Since, the learners would become the transferors for their learning and the transferors would become the learners for their forget, the number change of learners is not only related to the time t but also related to the former time unit. The model 3 can be described as follows:

$$(N_2S_2)' = v_2N_2T_2(t-\tau) - \beta_{12}S_2T_1N_1k \quad (4)$$

There, τ is time delay. The model 4 could be showed as Fig. 2.

The tacit knowledge model can be described as follows:

$$\begin{cases} (N_2S_2)' = v_2N_2T_2(t-\tau) - \beta_{12}S_2T_1N_1k \\ (N_2T_2)' = \beta_{12}S_2T_1N_1k - v_2N_2T_2 \\ N_2(T_2+S_2) = N_2 \\ N_2S_2(0) = N_2 \\ N_2T_2(0) = 0 \\ 0<k<1 \end{cases} \quad (5)$$

The model 5 can be simplified when it is divided by N_2:

$$\begin{cases} S_2' = v_2T_2(t-\tau) - \beta_{12}S_2T_1\dfrac{N_1}{N_2}k \\ T_2' = \beta_{12}S_2T_1\dfrac{N_1}{N_2}k - v_2T_2 \\ T_2 + S2 = 1 \\ S_2(0) = 1 \\ T_2(0) = 0 \\ 0<k<1 \end{cases} \quad (6)$$

The model 6 can be simplified for $S_2' + T_2' = 0$:

$$\begin{cases} S_2' = v_2T_2(t-\tau) - \beta_{12}S_2T1\dfrac{N_1}{N_2}k \\ T_2' = \beta_{12}S_2T_1\dfrac{N_1}{N_2}k - v_2T_2 \\ T_2(t-\tau) = T_2(t) \\ T_2+S_2 = 1 \\ T_2(0) = 0 \\ 0<k<1 \end{cases} \quad (7)$$

The result is as follows:

$$\begin{cases} T_2' = \beta_{12} T_1 \frac{N_1}{N_2} k - (\beta_{12} T_1 \frac{N_1}{N_2} k + v_2)\, T_2(t-\tau) \\ T_2(0) = 0 \\ 0<k<1 \end{cases} \quad (8)$$

It is defined:

$$\beta_{12}\, T_i \frac{N_1}{N_2} k$$

as δ_{12}, i.e., the communication number of transferors in organization 1 with other members in organization 2. So, the Eq. 8 can be simplified further:

$$\begin{cases} T_2' = \delta_{12} - (\delta_{12} + v_2)\, T_2(t-\tau) \\ T_2 0) = 0 \\ 0<k<1 \end{cases} \quad (9)$$

ANALYSIS OF TACIT KNOWLEDGE MODEL

It is supposed that the members in organization 1 are equal to those in organization 2. Besides, it is apparent that $0<\delta_{12}<1$ and $v_2>1$.

The analysis of τ:

- **τ when T_2 is in balance:** It is analyzed how the number of transferors in organization 2 change with the time when forget proportion and contact keep constant. The change curve of T_2 with t can be described from Fig. 3-6 when v_2 is set to 0.006, δ_{12} is set to 0.9 and τ belongs to (0, 1.73). The line is tend to be constant after a curve and $T_2^* = 0.9934$. This suggests the transferors will tend to be constant with the cooperation
- **τ when T_2 is in periodic fluctuation:** Hopf bifurcation refers to the local birth or death of periodic solution (self-excited oscillation) from an equilibrium as a parameter crosses a critical value and it is an important dynamical bifurcation (Liu, 2011). The change curve of T_2 with t can be described from Fig. 7-9 when v_2 is set to 0.006, δ_{12} is set to 0.9 and τ belongs to (1.73, 2). This suggests there are Hopf bifurcation and periodic change

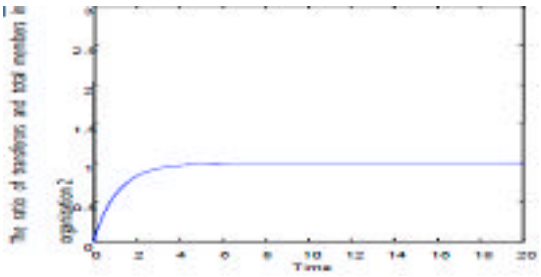

Fig. 3: Transferors curve of T_2 with t

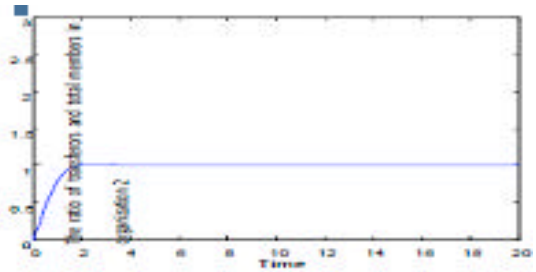

Fig. 4: Transferors curve of T_2 with t

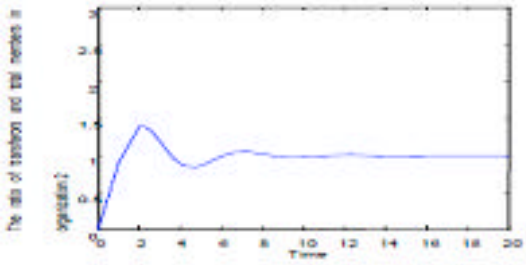

Fig. 5: Transferors curve of T_2 with t

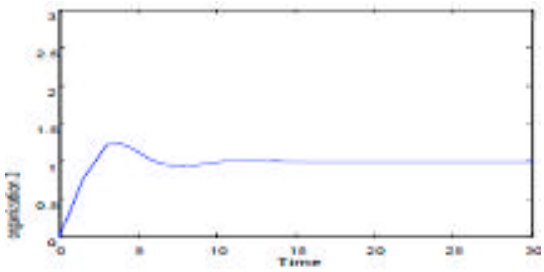

Fig. 6: Transferors curve of T_2 with t

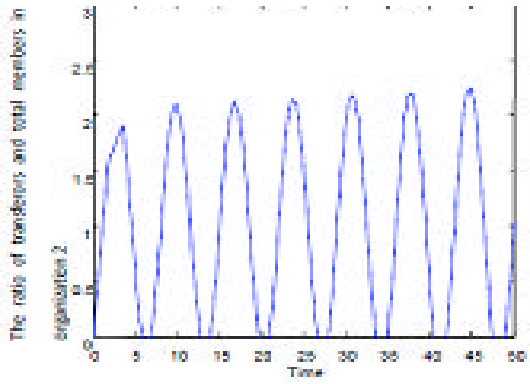

Fig. 7: Hopf bifurcation curve of T_2 with t

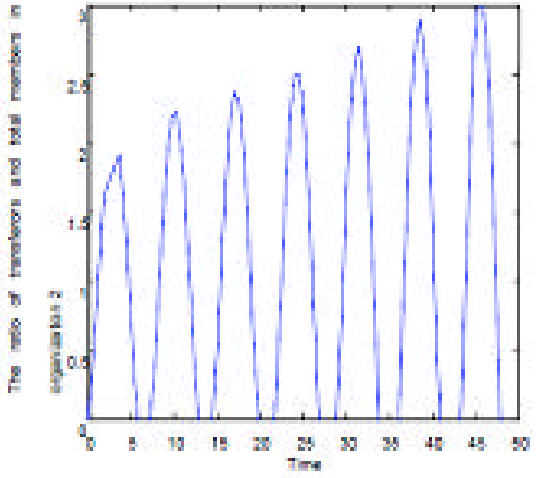

Fig. 8: Hopf bifurcation curve of T_2 with t

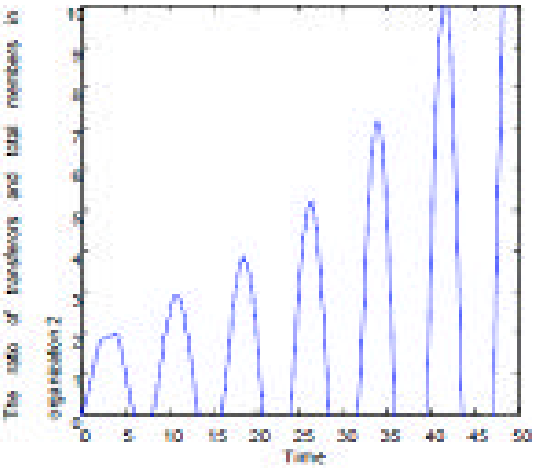

Fig. 9: Hopf bifurcation curve of T_2 with t

There is a periodic variance of the proportion of transferors and total members when the hidden time of tacit knowledge is prolonged, i.e., $\tau \epsilon (1.73, 2)$.

The transfer efficiency of tacit knowledge between two organizations can be described as the increase of T_2. The probable results are listed because of the time delay:

- The number of transferors will tend to be stable with the cooperation when forget proportion and contact frequency are set and time delay belongs to (0, 1.73)
- The number of transferors will have a periodic change and have an Hopf bifurcation when forget proportion and contact frequency are set and time delay belongs to (1.73, 2)

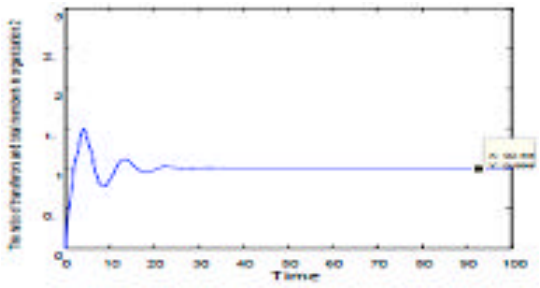

Fig. 10: Variance curve of V_2 with T_2

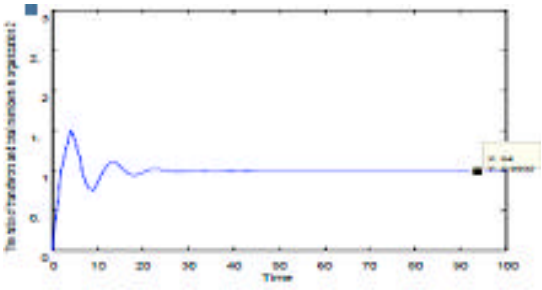

Fig. 11: Variance curve of V_2 with T_2

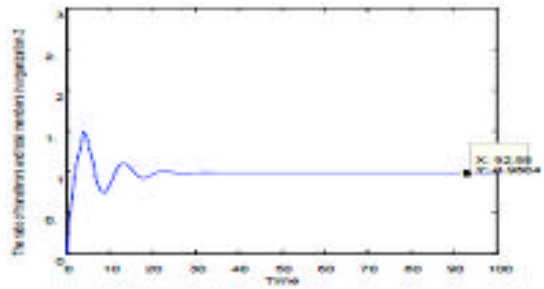

Fig. 12: Variance curve of V_2 with T_2

Influence of forget ratio on T_2: The variance of v_2 would influence T_2 when contact frequency is set and time delay belongs to (0, 1.73). The variance of v_2 is showed from Fig. 10-13 when δ_{12} is set to 0.5 and τ is set to 2.

These figures suggests T_2 will decrease with the increase of v_2 when δ_{12} and τ are set, i.e., the increase of forget ratio would decrease the transfer efficiency of tacit knowledge.

Influence of contact frequency on T_2: The variance of contact frequency would influence T_2 when forget ratio is set and time delay belongs to (0, 1.73). The variance of δ_{12} is showed from Fig. 14-17 when v_2 is set to 0.06 and τ is set to 1.

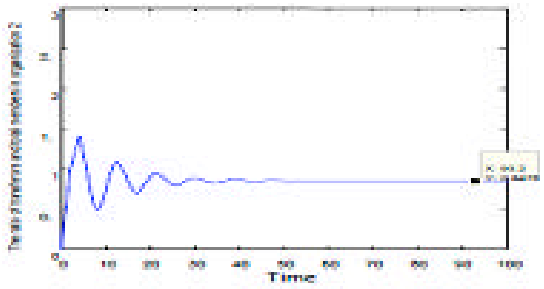

Fig. 13:Variance curve of V_2 with T_2

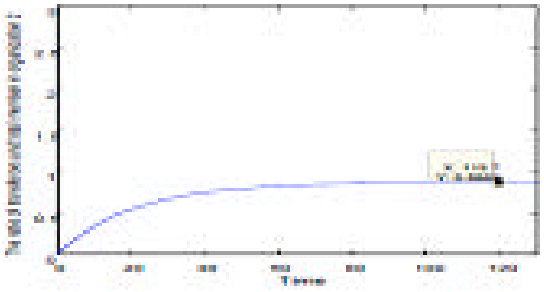

Fig. 14: Curve of frequency with T_2

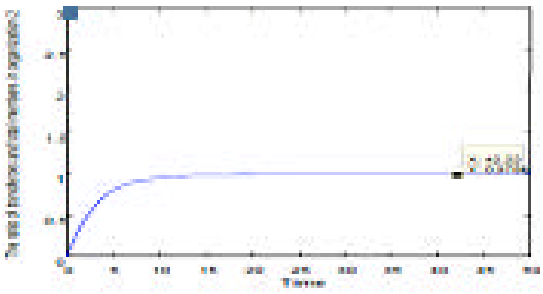

Fig. 15: Curve of frequency with T_2

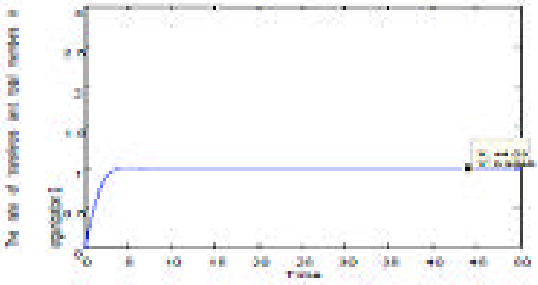

Fig. 16: Curve of frequency with T_2

These figures suggests T_2 will decrease with the increase of δ_{12} when v_2 and τ are set and get a balance finally. In other words, the ratio of transferors and total members in organization 2 would increase with contact frequency.

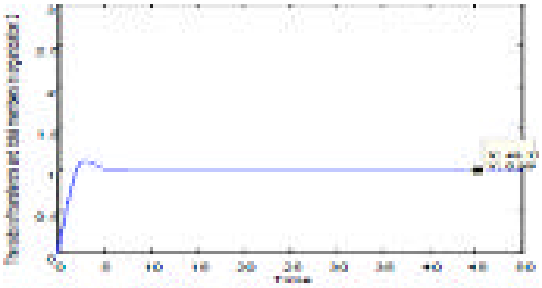

Fig. 17: Curve of frequency with T_2

The contact frequency is influenced by transferors' number, the ratio of members in organization 1 and 2, the ratio of transferors taking part in cooperation and total members in organization 1 and contact ratio. Therefore, transfer efficiency will be improved when these variables are increasing. In other words, transfer efficiency will be positively related to these four variables while negatively related to forget ratio.

CONCLUSION

The transfer efficiency of tacit knowledge between organizations is influenced by some indicators such as members taking part in cooperation, forget ratio, transferors and so on.

The transfer efficiency of tacit knowledge has two probable trends with the hidden time of tacit knowledge. One is the number of transferors in organization 2 will get into a balance. The other is the number of transferors in organization 2 will have a Hopf bifurcation and periodic variance. In order to improve the ratio of transferors, the firm should take some incentive measures and change the hidden time of tacit knowledge.

The contact frequency is positively related to contact ratio and the proportion of transferors of tacit knowledge. Therefore, it is sure to improve transfer efficiency when more organization members have taken part in cooperation and effective contacts.

All in all, the transfer efficiency of tacit knowledge is positively related with transferors with tacit knowledge, the ratio of organization members, contact ratio and the ratio of cooperation members with tacit knowledge while negatively related with forget ratio. During the course of cooperation, it is beneficial to improve transfer efficiency of tacit knowledge when more organization members take

part in cooperation, have efficient contact and suitable incentive measures and control the hidden time of tacit knowledge rationally.

ACKNOWLEDGMENTS

This study is supported by National Natural Science Foundation of China (No. 11272277), Program for New Century Excellent Talents in University (NCET-10-0238), the Key Project of Chinese Ministry of Education (No. 211105), Soft Science Research Program of Henan Province(122400440011,132400410042),High-leveltalent research start-up project of NCWU (No. 201009), The Key Project of the Education Department of Henan Province (2009A630031, 12B630028) and Special funds for public welfare of The Ministry of Water Resources.

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