Human Factors & Knowledge Management: A System Dynamics Based Analysis

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ABSTRACT:

Post globalization, in the IT sector, there has been a shift towards efficient managing of knowledge assets, owing to its importance in ensuring sustainability. This paper studies the 'people' dimension of the Knowledge Management (KM) initiative in a typical Information Technology (IT) industry. Organizational culture and Top management commitment & support are Critical Success Factors (CSFs) considered in this research. The interdependencies between factors are considered while developing a System Dynamics (SD) model and the influence of the variables belonging to the human dimension of KM are varied dynamically, to study their influence, on Knowledge Management System (KMS) performance, in conjunction with the other success factors. The simulation results exhibit the advantage gained by KMS, by reducing the delay in cultural transformation, and lowering the rate of erosion of congenial culture. The results also underscore the importance of consistent and continued support of the top management, for the success of KMS.

Keywords: *Knowledge Management, CSF, System Dynamics, Organization Culture*

1. Introduction

In the modern era of Knowledge Economy, KM is considered as a reliable and proven way to manage the knowledge assets in an organization to gain competitive advantage. It helps to improve the overall organizational performance by developing organizational memory and increasing the rate of innovation. The active and dynamic implementation & management of knowledge are critical to enabling organizational performance enhancements, problem solving, decision making, and teaching (Liebowitz, 1999).

The Information Technology (IT) industry has one of the most knowledge intensive organizational setups in the current global economy. They are highly dependent on the experience and knowledge of its employees, mostly tacit in nature, for their survival in the market. The knowledge of the people is the largest asset of such organizations as it is the key ingredient of innovation. One of the main intentions of implementing Knowledge Management System (KMS) in an IT industry is to develop organizational memory so that the focus is shifted from being employee centric to knowledge centric organization. However, for any organization implementing KMS, the 'human dimension' (referred to as people dimension in KM literature) is very much crucial for its success. Employees, at the same time being the users, can be creators and contributors to the KMS: The voluntary sharing of knowledge by individuals is a key element in the implementation and success of any knowledge-management endeavour (Ekbia & Hara, 2006).

Knowledge management caters to the critical issues of organisational adaptation, survival and competence in the face of increasingly discontinuous environmental change and it is the only tool that helps an organization to gain insight and understanding from its own experience (Singh & Soltani, 2010). Schneider (2009) observed that applying KM in an IT industry can have many positive impacts. It helps to carry out the software engineering activities faster without compromising on the quality of the process. It improves communications around complex software engineering tasks and makes individuals more independent, which results in less supervision. It also helps to combine tasks more effectively and recognise problems much faster, which reduces the work time on an activity, thereby freeing resources for other tasks. KM plays an important role in expanding the range of project situations in which one can perform competently and increase the ability to handle difficult tasks and taking on tasks of greater complexity.

There are various factors which have been identified crucial to the success of a KMS, often referred to as the Critical Success Factors (CSFs) of KM. Like the various KM definitions in place, there aren't any fixed set of CSFs which can be directly attributed to KM success. This can be due to the various levels of representation of different CSFs by researchers, and also, depends upon the nature of business. Although, for a close observer, ultimately the CSFs of KM distils down to the five primary factors: Top Management Commitment & Support, Organization Culture, KM Organization & Process, KM Tools & Technology, and KM Metric & Incentives. These are the five CSFs which are focused in this paper while developing the System Dynamics (SD) model which determines the performance of a KMS. Although different factors, they primarily belong to the three important dimensions of KM which are People, Process and Technology. The focus of this paper will be on the people dimension and how the associated CSFs affect the performance of KMS in an IT sector. However, the study of influence of these factors cannot be done in isolation, as the systems perspective must be taken into account in order to examine the actual behaviour of the system when different variables interact with each other. If we tend to focus only on a small part of the system, ignoring the larger picture, we are subject to the learning disability "I am my position" (Senge, 1990), which results in overlooking the otherwise important patterns of the system. Nevertheless, a focussed study on people dimension alone may open up issues, which need attention, as most of the problems faced by the knowledge driven organizations are in this area and not on processes or technology area.

2. Literature Review

Knowledge management offers IT organizations many strategies, techniques, and tools to apply to their existing business processes so that they are able to grow and effectively utilise their knowledge assets. The KM diamond (Figure 1) highlights the importance of the impact of the three elements of KM, people, process & technology on the four steps of knowledge management (KM) which are create/generate, represent/store, access/use/re-use and disseminate/transfer. A KM initiative to be successful requires consideration and interactions among all of these components (Wickramasinghe, 2006).

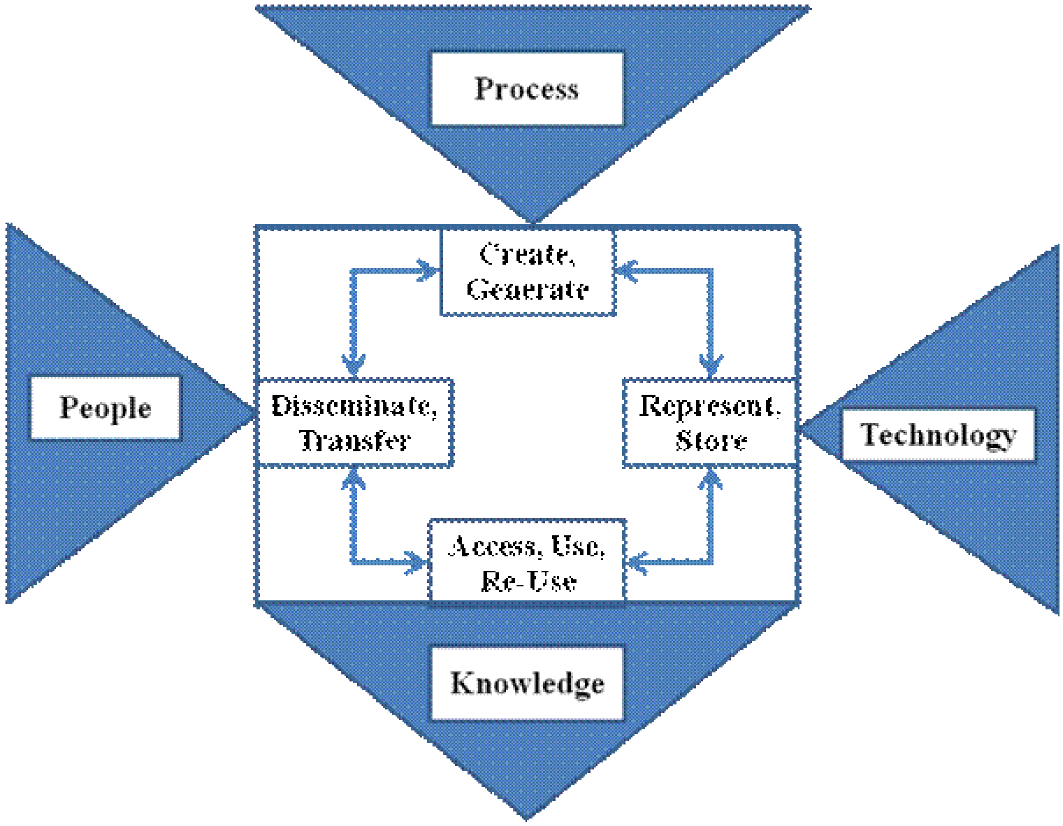

Figure 1: KM Diamond – People, Process & Technology (Wickramasinghe, 2006)

This paper focuses on one of the elements of KM, the people, and tries to identify how the people factor can affect the KMS when it interacts with the other two critical elements of KM, the process and technology. 'People' is the most important factor in a KM initiative as without their involvement, the other two elements have little meaning. Out of the five CSFs identified, this paper analyse two factors, related to the people dimension viz., organization culture & top management commitment and support. An overview of these factors is given in the following sections.

2.1. Organization Culture

One of the most important CSFs for KM success, belonging to the people dimension, is to have a favourable Organization Culture (Davenport, et al., 1998; Alavi & Leidner, 1999; Sage & Rouse, 1999; Jennex & Olfman, 2000; Barna, 2002; Yu,et al., 2004; Bhirud,et al., 2005) which nourishes the development of KM practise. No matter even if you have the best technology and other resources which support KM implementation, if the employees are not willing to share their knowledge that puts the whole KM programme in jeopardy. So, probably the first step to have a successful KM programme is to create a culture of mutual trust (Ribiere & Tuggle, 2005), which enables knowledge sharing and results in organizational learning. The learning organization principles of Personal Mastery, Mental Models, Shared Vision, Team Learning and Systems Thinking (Senge, 1990) forms the much needed foundation for a strong culture which enables the success of the KMS.

Yazdani et al. (2011) suggests that to develop a knowledge management system and achieve its objectives in an organization requires a corporate culture for changing its activities to knowledge-based, and also its staff become knowledge-based workers, which means creating a culture of knowledge management that support knowledge sharing and value creation and encourage its use.

According to Ernst &Yong study, 50 percent of experts believe that changing human behaviour is one of the key issues in the KM implementation (Bhatt, 2001).

2.2. Top Management Commitment & Support

Very few initiatives in an organization can be successful without the support of the Top Management. It plays an inevitable role in the case of KM implementation also, largely due to the relative novelty of the concept. When the leadership is committed and supportive, it instils that confidence in the employees to go out and practise something, which is completely new to them. Davenport et al. (1998); Holsapple & Joshi (2000); Jennex & Olfman (2000); Barna (2002); Yu et al (2004); Bhirud et al. (2005) and Wong (2005) have noted Top Management Commitment & Support (TMCS) as a key factor in the success of KM. In brief, top management is the initiator, sponsor and promoter of KM and it is responsible for providing enough financial resources and time for the KMS (Lehner & Haas, 2010).

Zyngier (2005) has noted that the culture of an organization is developed by the structure, attitude, and example of management. Krogh et al. (2000) describe how effective management and the support of knowledge creation depend on the physical, virtual, and emotional context in which they are manifested. Where there is a strong commitment at the level of executive management to change organizational culture, an organization is able to begin to create the values that lead to knowledge sharing across boundaries (Hackett, 2000; O'Dell et al, 1998).

3. System Dynamics Model

The SD methodology was proposed by J.W. Forrestor. It includes mainly five stages which are inter-related viz., Problem Identification, System Conceptualization, Model formulation, Simulation & validation, and Policy analysis & improvement (Sushil, 1993). The objective of the model in this paper is to identify the relationships between the different CSFs and also to study the effect of the variables pertaining to the people dimension of KM, on the improvement of KMS over a period of time. The software used for simulation is VenSim®.

The causal loop diagram shows the inter-relationships of the different variables under consideration. It was identified that there are three reinforcing loops and two balancing loops in the causal loop diagram (Figure 2). The first reinforcing loop is between level of acceptance and organization culture favourable to KM. As the level of acceptance is increased, it increases the organization culture, which in turn increases the level of acceptance. The second reinforcing loop is between the organization culture and the erosion of culture congenial to KM. When the erosion of culture increases, the organization culture decreases, which in turn decreases the erosion of culture. The third reinforcing loop is formed by the level of acceptance, erosion of culture and organization culture. An increase in level of acceptance can reduce the erosion of culture, which increases the organization culture and that in turn results in improving the level of acceptance. There is also a delay between the level of acceptance and organization culture and also between the erosion of culture and organization culture.

The two balancing loops in the model are between adoption of technology, and KM tools and technology (KTT) and between obsolescence of technology and KTT. In the first loop, when technology adoption ratio is increased it increases the level of KTT, which in turn can reduce the technology adoption ratio for acquiring more technology. In the second balancing loop, when the obsolescence rate increases, the KTT reduces and the obsolescence rate also reduces as a result.

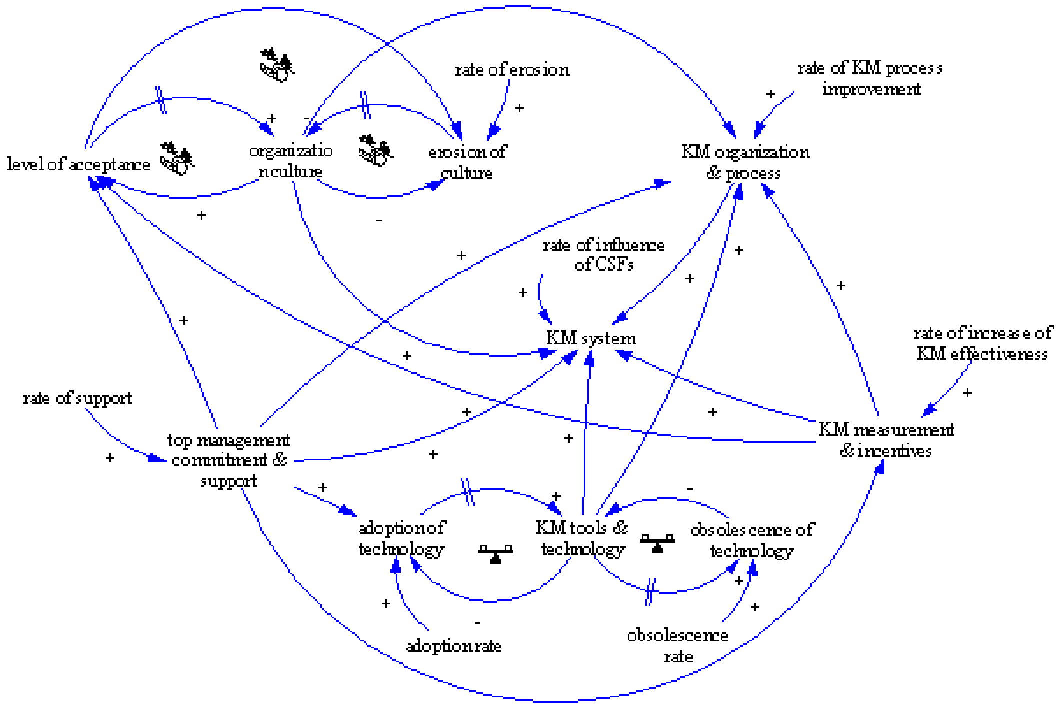

Figure 2: Causal Loop Diagram Showing Inter-Relationships Of CSFs And KMS

The variables coming under the people dimension, which are studied in detail in this paper are, organization culture and top management commitment & support. As per the causal loop diagram the factors influencing the organization culture are top management commitment & support and KM measurement & incentives.

The causal loop diagram forms the basis for the development of the stock and flow diagram (Figure: 3), in which, the KMS performance is studied against the variations in following variables:

- Delay in cultural transformation: It denotes the delay in months, taken by the employees of the organization to acquire the new culture congenial for KM.
- Rate of erosion of culture congenial to KM: It is the rate at which the acquired culture favourable to KM is eroded.
- Top management commitment and support (TCMS) index: It denotes the level of commitment and support of the top management, given for the KM initiative.

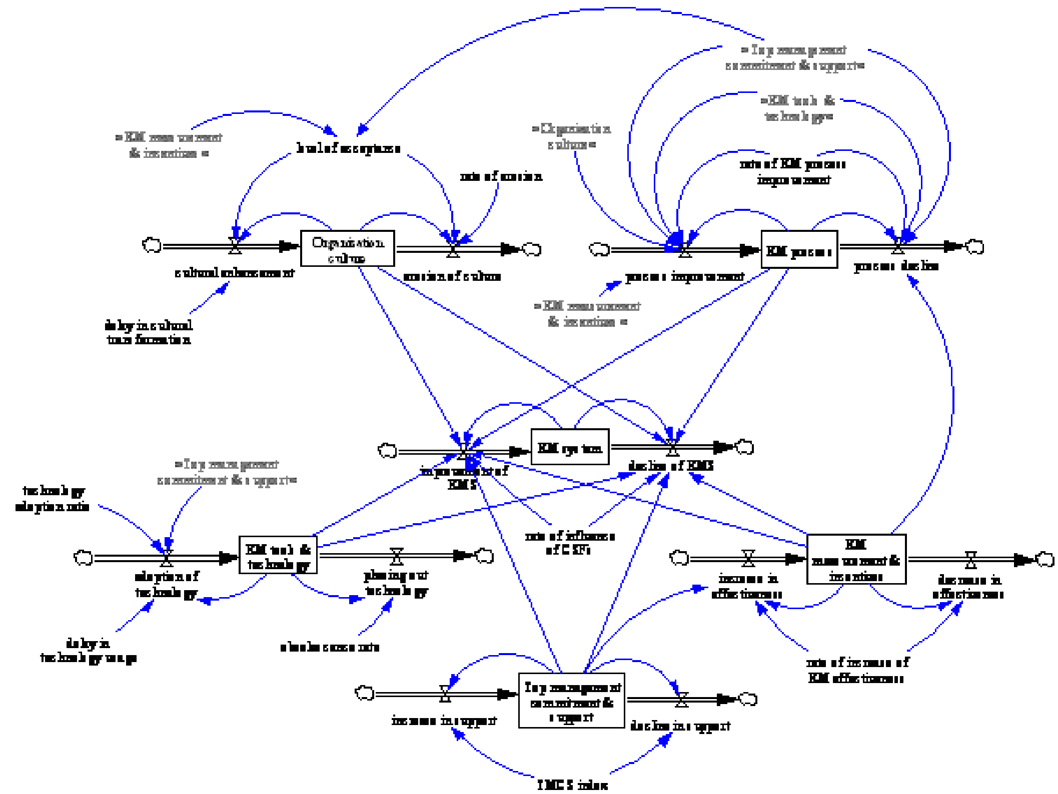

Figure 3: The Stock & Flow Diagram Of Knowledge Management Success

3.1. Validation of the Model

Validation is the process of establishing confidence in the usefulness of a model (Coyle, 1977). The process of validation can determine whether the model on which simulation is based, is an acceptably accurate representation of reality (Giannanasi et al., 2001). There is no single test that would allow the modellers to assert that their models have been validated. Rather, the level of confidence in the model can increase gradually, as the model passes more tests (Forrester & Senge, 1980).

The current model was tested using the set of validations procedures laid out by Rodrigues et al. (2006) for testing a SD model. The details of the tests conducted and their respective results are described in Table 1.

Table 1: Validation & Test Results Of The Model

Test	Purpose of Test	Results
1. Validating Model Structure		
a) Tests of Suitability		
i. Structure-Verification Test	Is the model structure not in contradiction to the knowledge about the structure of the real system, and have the most relevant structures of the real system being modelled?	The most relevant structures of KMS, as per the literature have been considered for model design.

ii. Dimensional-Consistency Test	Do the dimensions of the variables in every equation balance on each side of the equation?	The dimensions of all the variables were checked and the equations were verified and balanced e.g., erosion of culture=Organization culture*rate of erosion*(1-level of acceptance), LHS = RHS = 1/Month [Refer Appendix I for full list of equations]
iii. Extreme-Conditions Test	Does every equation in the model make sense even if subjected to extreme (but possible) values of variables?	Every equation has been tested for extreme values. For instance, when the TMCS index was set to zero, the KMS showed no improvement. It means that, the model is capable of not losing its confirmations in the eventuality of using extreme values.
iv. Boundary-Adequacy Test	This test verifies whether the model structure is appropriate for the model purpose	As the model indicates, it considers all important variables related to the system as per the various available literature
b) Tests of Consistency		
i. Face Validity Test	Does the model structure look like the real system? Does a reasonable fit exist between the feedback structure of the model and the essential characteristics of the real system?	The model has been developed in line with the real life situations existing in successful KM organizations, as analysed by various researches
ii. Parameter-Verification Test	The numerical values of parameters should *Tests of Suitability* have real system equivalents.	The parameters correspond conceptually and numerically to real life. e.g., a delay of 2 months for cultural transformation is realistic from an IT industry perspective.
c) Test of Utility and Effectiveness		
i. Appropriateness for the Audience	The more the appropriate a model for the audience, the more will be the audience's perception of model validity	The model is easy to understand with simple feed-forward & feedback structures. All the terms used are appropriate to the context and easily understandable by the practitioners.
2. Validating Model Behaviour		

a) Tests of Suitability		
i. Parameter Sensitivity Test	Do the modes of behaviour change with the parameter variations	Behaviour change is observed when parameters are varied. e.g., when the delay in cultural transformation increases, the KMS success is proportionately delayed (Figure 4)
ii. Structural Sensitivity Test	Is the behaviour of the model sensitive to reasonable structural reformulation	Any reformulation to the model's structure would cause the results to change.
b) Tests of Consistency		
i. Behaviour-Reproduction Test	Here, the generated model behaviour is judged with the historical behaviour pattern.	This model has used hypothetical values to conduct the simulation. However, the patterns generated in the simulations are in tune with the patterns in real-life situations, such as erosion of culture, management support etc. (Figures 4 - 7)
ii. Behaviour-Prediction Test	Whether or not the model generates patterns of future behaviour in terms of periods, shape or other characteristics	The model predicts the behaviour of the system up to a period of 42 months and the patterns are revealed
iii. Behaviour-Anomaly Test	What behaviour shown by the model is conflicting with the real system behaviour and how implausible behaviour arises if the assumptions are altered?	No erratic behaviour was observed during the course of the simulation and hence, anomaly of any kind does not exist.
iv. Family Member Test	Parameter values are chosen to depict a particular situation. By choosing a different set of parameter values can the model be applied to other situation as well?	Parameter values can be varied to analyse different situations. For example, a TMCS index of 0.2 denotes low support from management where as 0.8 denotes good support (Figure 6).
v. Surprising Behaviour Test	Does the model under some test circumstances produce dramatically unexpected or surprise behaviour, not observed in the real system	No surprising behaviours were observed under test circumstances
vi. Extreme-Policy Test	If the model behaves in an expected fashion even under extreme policies, then it boosts confidence in the model.	Model when subjected to extreme conditions behaves as expected. No abnormalities are

		observed. For example, when the TMCS index is set at a hypothetical maximum of 1, the KMS reaches peak performance in the shortest possible time.
vii. Boundary Adequacy Test	If the extra model structure does not change the behaviour, then this extra structure is not necessary. Alternatively, if a model structure does not reproduce desired model behaviour, it calls for inclusion of additional model structure.	All the structures considered are important & influences the model behaviour significantly and the behaviour of the system in the absence any of these structures was observed to be quite different
viii. Behaviour-Sensitivity Test	Does plausible shift in parameters cause model to fail behaviour tests previously passed?	The model is quite sensitive to the variations in the policy parameter.
ix. Statistical tests	Does the model pass statistical tests based on the data from real system?	
c) Test of Utility and Effectiveness		
i. Counter Intuitive Behaviour	In response to some policies, does the model exhibit behaviour that at first contradicts intuitions, and later, with the aid of the model, is seen as a clear implication of the structure of the system?”	When TCMS index is reduced by 50% it is expected to reflect in the KMS performance immediately. But, KMS continues to grow 6 more months and then starts declining, owing to the performance of other factors of the system (Figure 7).
3. Validating Policy Implications		
a) Test of Suitability		
i. Policy Sensitivity and Robustness Test	Does the model based policy recommendations change with reasonable changes in the parameter values, or reasonable alteration in the equations?	The results of this test where positive and the model is robust.
b) Tests of Consistency		
i. Changed Behaviour Prediction Test	Does the model correctly predict how the behaviour of the system would change if the governing policy is changed?	This test has shown that the model correctly predicts how behaviour of the system will change if a governing policy is changed (Figures 4-7)
ii. Boundary Adequacy Test	Does modifying of the model boundary alter policy recommendations?	This test has shown that modifying the model boundary would alter policy recommendations

iii. System Improvement Test	Are the policies found beneficial after working with a model?	
c) Test of Utility and Effectiveness		
i. Implementable Policy Test	Can those responsible for policy making in the real system be convinced of the values of model-based policy recommendations?	The implications of the model are convincing & practical and hence can be recommended for real life scenarios e.g., reduction in erosion of culture can have positive results on KMS performance (Figure 5).

4. Results And Discussion

The variables, constants, and their units used in the model are given in the Table 2 scenario wise. An influence rate of CSFs is set as 0.9 (factors contributing to 90% of KM success) in all cases to give room for any extraneous factors which may be influential in the performance of the KMS, but not considered in the current model. The obsolescence rate of technology is assumed to be zero for the first year, considering the fact that the latest technology is initially acquired, but it gradually starts becoming obsolete starting from the second year.

Table 2: Variables And Constants Used For Simulation

Variables and Constants	Range (Min-Max)	Unit	Scenario 1	Scenario 2	Scenario 3	Scenario 4
y in cultural transformation	–	Months	Dynamic	2	2	6
of erosion of culture	0 – 1	Per Month	0.05	Dynamic	0.05	0.05
S index	0 – 1	Per Month	0.7	0.7	Dynamic	Dynamic
nology adoption ratio	0 – 1	Per Month	0.7	0.7	0.7	0.7
y in technology usage	–	Months	2	2	2	3
of increase in KM effectiveness	0 – 1	Per Month	0.7	0.7	0.7	0.7
of KM process improvement	0 – 1	Per Month	0.7	0.7	0.7	0.7
of influence of CSFs	0 – 1	Per Month	0.9	0.9	0.9	0.9
lescence rate of technology*	0 – 1	Per Month	0.02	0.02	0.02	0.02

rts from 2nd year

5. Scenarios

The following scenarios are analysed using the SD model to study the influence of people dimension of KM and related factors, when it interacts with the other variables of the KM environment:

5.1. Scenario 1: Effect Of Delay In Cultural Transformation On KMS Success

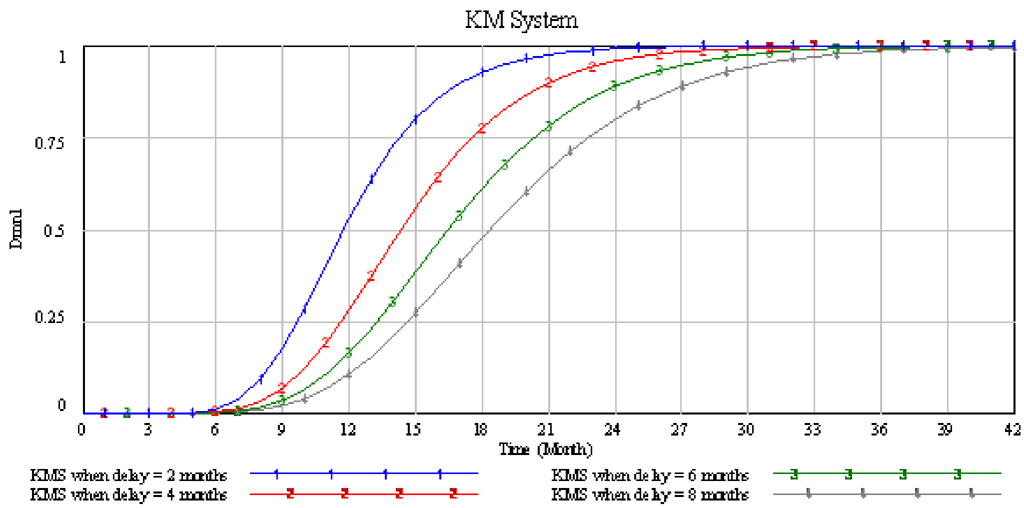

Figure 4: Effect Of Delay In Cultural Transformation On KMS Success

5.1.1. Results & Analysis

This analysis was done to investigate the effect of delay in cultural transformation on the KMS success. A total of four simulation runs were performed by varying the delay variable (2, 4, 6 and 8 months). The results (Figure 4) show that the delay in cultural transformation has a significant influence on KMS success. The larger the delay, the greater will be the time for reaching peak performance.

5.1.2. Inferences

The results clearly indicate that the delay in cultural transformation is directly proportional to the duration required for KMS success. A one month delay in cultural transformation is seen to be delaying the KMS success by around three months. Also, when the delay increases the time taken for the KMS to take off from the initial plateau also increases.

5.1.3. Implications & Suggestions

The delay in the system can prolong the KMS success even when all other factors are given due consideration. Here, the delay in cultural transformation can be looked at, as one of the systems archetype “limits to growth” (Senge, 1990). The delay acts as a limiting factor, which tries to delay the growth & success of the KMS. The management, in such circumstances, instead of trying too hard to push the reinforcing loop of growth, should try to minimise the effect of the limiting factor, which is the delay in cultural transformation.

The management needs to identify the causes contributing to the delay of cultural transformation and try to start addressing them at the shortest possible time. The delay can be caused due to the “fear of the unknown” factor and also not being sure about the benefits of accepting a new culture, which may result in resistance. It is important that the management gives the necessary psychological boosting to its employees to remove the fear factor and also instil in them the confidence to embrace the new culture for the benefit of the organization and self. Reducing the delay is very much important as it has a threefold effect in reducing the duration needed for KMS success (Figure 4).

5.2. Scenario 2: Effect Of Rate Of Erosion Of Culture On KMS Success

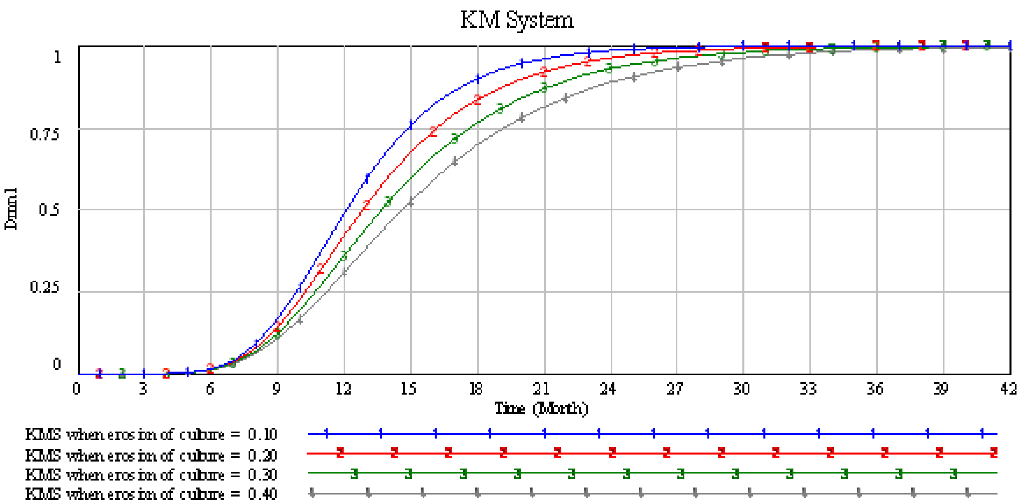

Figure 5: Effect Of Rate Of Erosion Of Culture On KMS Success

5.2.1. Results & Analysis

The way there is force acting towards the enhancement of the culture to the desired level, there is also another force which is opposing its growth. This results in the erosion of the achieved level of culture. Four simulation runs are performed by varying the rate of erosion of culture (Figure 5). The rate of erosion was increased from 0.1 to 0.4 in steps of 0.1. The simulation depicts that higher the rate of KM culture erosion, greater will be the time taken by the KMS to reach peak performance.

5.2.2. Inferences

Similar to the delay in cultural transformation, the rate of erosion of culture is also directly proportional to the duration required for KMS success. A 10% interval rise in the rate of erosion is found to delay the KMS success by 4 months.

5.2.3. Implications & Suggestions

Erosion of culture congenial to KM can be considered as another limiting factor of growth in the SD model. It should be dealt with the same amount of seriousness, as it has been suggested in the case of delay in cultural transformation.

The increase in the rate of erosion can be due to various factors such as influence of the employees who resist change, the employees who may leave the culture due to lack of motivation & incentives or due to high level of attrition of employees (Singh, 2004). Whatever the reason may be, it must be identified at the earliest stage and the rate of erosion should be controlled. Ideally speaking, keeping the erosion levels below 10% should be the target of the management, as it positively improves the duration required for KMS success. Awareness programmes directed towards the importance of retention of acquired culture would be effective in achieving low erosion rates. Timely incentives to recognise the knowledge work done can also motivate the knowledge workers, to remain devoted to the culture.

5.3. Scenario 3: Effect Of Variation Of TMCS Index On KMS Success

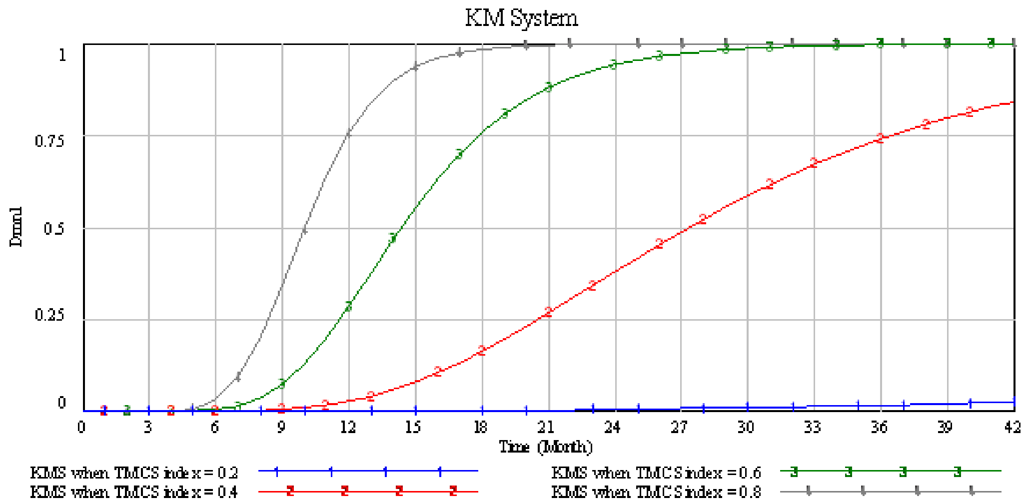

Figure 6: Effect Of Variation Of TMCS Index On KMS Success

5.3.1. Results & Analysis

In the third scenario (figure 6), the effect of TMCS index on KMS success is considered. The rate of support is varied in intervals of 0.2, starting from 0.2 to 0.8. Out of the four simulation runs, the curve of KMS success, at a TMCS index of 0.2, fails to rise from the initial plateau and results in a complete failure. When the index is increased to 0.4 the KMS curve is observed to show some improvement but still fails to reach the desired success level in a given time period. The simulation runs with index 0.6 and 0.8 reaches the desired level of success at around 31 and 19 months respectively.

5.3.2. Inferences

The positive effect and the leverage of TMCS on KMS success are more than obvious. The higher the top management support, the shorter is the time taken to reach peak KMS performance.

5.3.3. Implications & Suggestions

Small changes can produce big results – but the areas of highest leverage are often least obvious. The most obvious solutions may not always give great results. System thinking shows that, small, well-focused actions can sometimes produce significant, enduring improvements, if they are in the right place, which is often referred to as "leverage" (Senge, 1990).

An organization looking to achieve KMS success in minimum possible time cannot afford a TMCS index less than 0.6 (60 % support). The success rate can be even further improved if the support is increased to higher levels. A small improvement in the TMCS can have multi-fold impact on the KMS success. It is important that all the members of the top management should be clear about the benefits of implementing a KMS and act in unison to improve the levels of commitment and support. The support should be extended to the project managers who handle individual IT projects by providing them with adequate funds for managing the KM processes. Top management can also consider developing various kinds of training programs, depending on the needs of different projects (Anantatmula, 2005).

5.4. Scenario 4: Effect Of Fluctuating TMCS Index On KMS Success

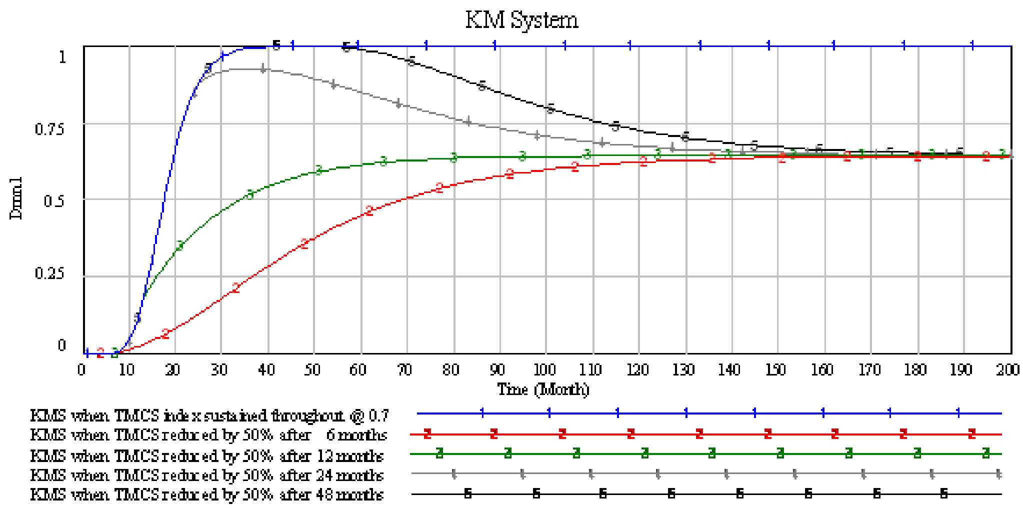

Figure 7: Effect Of Fluctuating TMCS Index On KMS Success

5.4.1. Results & Analysis

It would be interesting to find out the possible results if the top management is not satisfied with the return on investment (on a short term basis) ignoring the influence of delay. Figure 7 shows the effects of reducing the TMCS index at various stages. All other CSFs are kept at a constant level (Table 2) except the value of TMCS index which is reduced by 50% after a period of 6, 12, 24 and 48 months respectively. The curve of the first run represents the KMS when support (TMCS = 0.7) is sustained throughout the time period without any reduction.

5.4.2. Inferences

If the TMCS is reduced after 6 months owing to the fact that the KMS programme is not taking off as expected, the KMS does not take the actual steeper success path (run 1) but instead deviates and takes a sluggish path of growth (run 2) and finally flattens out without any further improvement. The same is observed in the case of run 3 also, when the support is withdrawn partially after 12 months.

In the run 4, TMCS is partially withdrawn after a period of 24 months when the KMS is almost nearing success and in Run 5 it is done after a period of 48 months, when the KMS has already touched its pinnacle. The interesting fact to be noted here is that when the support is withdrawn, in both the cases, the KMS does not plunge to a valley immediately, instead it is observed to sustain its growth for 6 more months and then start taking a downward path.

5.4.3. Implications & Suggestions

The inferences obtained out of this scenario calls for the management to render consistent support and be patient for the results to unfold. As one of the laws of systems thinking states, "cause and effect are not closely related in time and space" (Senge, 1990), the management should understand the delay of the system and should not expect immediate results. If they succumb to the delay of the system and reduce their support, the desired success of KMS can never be achieved. If the management support is not withdrawn, desired KMS performance will be reached by exponential rise and sustain the same for rest of the period.

The other possibility is that- when some level of success is achieved by the KMS, the management may think that the KMS can now sustain on its own, and hence, exhibit some level of complacency, which results in a gradual decline of TMCS for the KMS. However, the effect of this reduction of support does not reflect immediately on the KMS programme, as it is seen that it still continues to improve even after the support is reduced, but at a slower rate. This is due to the fact that even when the TMCS is reduced, the other factors in the system are still strong enough to sustain the growth of KMS for 6 more months. But later it becomes difficult for the other CSFs to sustain the growth without the support and commitment of top management, and hence, the KMS nose dives. This is again a typical example of a systems thinking law which states that, “behaviour grows better before it grows worse” (Senge, 1990). Therefore, when management reduces its support, initially the system as a whole gives an illusion that everything is still going on fine, when actually it is not. So if the management goes by the immediate results of their action, they are actually subject to the learning disability, “the delusion of learning for experience” (Senge, 1990), because, the consequences of many important decisions made, to take its effect, may take larger duration of time.

6. Conclusion

The CSFs, organization culture and top management commitment & support constitute the people dimension of a KM initiative. Even though you have the best technology and other resources which support KM implementation, if the employees are not willing to share their knowledge the KMS can never be successful. So, it is important to create a culture of knowledge management that support knowledge sharing and value creation and encourage its use. The top management support, for any initiative in an organization, is crucial to its success. This is no different in the case of KM, may be even more important, because of the very nature of the KM programme which needs co-operation from all parties. Especially in a business environment like IT, it is important that the management gives their employees enough time and resources to take part in the knowledge activities.

In this research, apart from the people factors, such as, organization culture and top management commitment & support, other CSFs like KM organization & process, KM measurement & incentives and KM tools & technology are also considered, in order to get the systems perspective. The causal loop diagram depicts the interactions of all the CSFs, which act in synch, for the success of the KMS. Using the stock & flow diagram, which was developed based on the causal loop diagram, the variables, delay in cultural transformation, rate of erosion of culture and TCMS index were dynamically varied to study their respective role in the KMS performance. The results depicted that, delay in cultural transformation and rate of erosion of culture needs to be controlled, to reduce the duration needed for KMS to reach its peak performance. Also, it was revealed that, TCMS offer great leverage for the KMS success and it is one of the most important factors contributing to the success and sustainment of a KM initiative, once it reaches peak performance. There is no room for complacency, at any stage of a KM initiative, by the top management.

The current model has considered the most important factors which have been discussed in the KM literature as the CSFs of KM. The possibility to extend the current model by adding new factors or even expanding a single factor in this model to study its underlying structure is always open for future research. For example, it would be interesting to dive deep into the people factors such as organization culture and top management commitment & support, to study the variables influencing their performance, individually. Another possibility of improving the model is to consider the variables at micro level and identify the interactions between them and analyse their behaviour. This model can act as a starting point for the researchers and SD modelling enthusiasts to analyse the various factors in detail which contribute to the success of KMS, and provide insights about the hidden patterns of the system.

7. References

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8. Appendix

(01) adoption of technology=technology adoption rate*(1-"KM tools & technology")*"Top management commitment & support"/delay in technology usage

Units: 1/Month [0,1]

(02) cultural enhancement=level of acceptance*(1-Organization culture)/delay in cultural transformation

Units: 1/Month

(03) decline in support="Top management commitment & support"*(1-rate of support)

Units: 1/Month [0,1]

(04) decline of KMS=KM system*(1-"KM measurement & incentives")*(1-"KM organization & process")*(1-Organization culture)*(1-"KM tools & technology")*(1-"Top management commitment & support")*rate of influence of CSFs

Units: 1/Month

(05) decrease in effectiveness="KM measurement & incentives"*(1-rate of increase of KM effectiveness)

Units: 1/Month

(06) erosion of culture=Organization culture*rate of erosion*(1-level of acceptance)

Units: 1/Month [0,1]

(07) FINAL TIME = 42

Units: Month

The final time for the simulation.

(08) improvement of KMS=(1-KM system)*"KM organization & process"*"KM measurement & incentives"*Organization culture*"KM tools & technology"*"Top management commitment & support"*rate of influence of CSFs

Units: 1/Month [0,1]

(09) increase in effectiveness="Top management commitment & support"*rate of increase of KM effectiveness*(1-"KM measurement & incentives")

Units: 1/Month

(10) increase in support=rate of support*(1-"Top management commitment & support")

Units: 1/Month [0,1]

(11) INITIAL TIME = 0

Units: Month

The initial time for the simulation.

(12) "KM measurement & incentives"= INTEG (increase in effectiveness-decrease in effectiveness, 0)

Units: Dmnl [0,1]

(13) "KM organization & process"= INTEG (process improvement-process decline, 0)

Units: Dmnl

(14) KM system= INTEG (improvement of KMS-decline of KMS, 0)

Units: Dmnl

(15) "KM tools & technology"= INTEG (adoption of technology-phasing out technology, 0)

Units: Dmnl [0,1]

(16) level of acceptance="KM measurement & incentives"*"Top management commitment & support"

Units: Dmnl

(17) obsolescence rate=STEP(0.02,12)

Units: 1/Month [0,1]

(18) Organization culture= INTEG (cultural enhancement-erosion of culture, 0)

Units: Dmnl [0,1]

(19) phasing out technology=obsolescence rate*"KM tools & technology"

Units: 1/Month [0,1]

(20) process decline="KM organization & process"*(1-rate of KM process improvement)*(1-"Top management commitment & support")*(1-"KM tools & technology")*(1-"KM measurement & incentives")

Units: 1/Month

(21) process improvement=Organization culture*rate of KM process improvement*(1-"KM organization & process")*"Top management commitment & support"*"KM measurement & incentives"*"KM tools & technology"

Units: 1/Month

(22) SAVEPER = TIME STEP

Units: Month [0,?]

The frequency with which output is stored.

(23) TIME STEP = 1

Units: Month [0,?]

The time step for the simulation.

(24) "Top management commitment & support"= INTEG (increase in support-decline in support,0)

Units: Dmnl

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