Indian Journal of Science and Technology, Vol 8(21), DOI:10.17485/ijst/2015/v8i21/78377 September 2015
ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645

A Study on Methodologies to Develop an e-Industrial Cluster Hub System using Social Networks

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Abstract

This study analyzed the structure of cooperation and competition among firms in various relationships of interest that participated in the establishment of an e-industrial cluster system using social networks and reflected the resulting implications in building an e-industry cluster hub system. Participating firms employed a variety of business models and highly complicated networks and their networks of cooperation and competition were quite inefficient and self-centric, thus failing to evolve a competitive structure from competitive pricing to competitive added value, through sharing of information, functions and processes using inter-firm networks. As such, this study attempted to apply information, functions and processes designed to improve upon various problems discovered from an analysis of social networks to the analysis and design of an e-industrial cluster system to accelerate the industries' evolution and to enhance national competitiveness. Examples of such application are also provided.

Keywords: e-Industrial Cluster, Hub System, Social Network Analysis

1. Introduction

This study aims to encapsulate networks of firms with various interests within an industry by analyzing their social networks centering on their own business models, as well as to suggest methodologies for analysis and design of hub systems designed to support industrial clusters, which will induce strategic alliance and fair competition amongst companies. The convention industry, suggested as a case study in this paper, comprises networks of companies with highly complex relationships of interest. Until now, it has been mostly driven by unfair competition using secretive, personal networks rather than fair competition based on cooperation and understanding. Little information is shared among different firms; as confidentiality of information is highly important and since no firm discloses its information to the other firms, it is difficult to obtain even basic statistical data that can be used for developing the convention industry. In particular, as convention centers are being built in local areas and each region establishes their own convention bureaus solely in charge of hosting conventions, inter- and intra-regional competition in the convention industry is becoming fiercer and fiercer. Korea Convention Bureau (KCB) under Korea Tourism Organization (KTO) is compiling basic data on conventions organized by the convention firms by providing souvenirs (giveaways) or financial support to organizers of conventions with the budget that it received from the Ministry of Culture and Tourism, in order to obtain basic statistical data for the convention industry. However, information on business meetings and incentive tourism, among others, has been mostly lost in the data collection.

Therefore, to develop the convention industry, understanding and consensus among participating firms within the industry are needed, as is an e-industrial cluster hub system to support the firms in an efficient manner. This study is an effort to promote mutual understanding

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of such situations through an analysis of social networks. The purposes of this study are as follows: 1. to define the concept and details of uniquely Korean e-industrial cluster by examining the concepts and characteristics of a conventional industrial cluster; 2. to analyze through social networks the relationships of alliance and competition among complex, relevant organizations and to analyze correlation through business models between them; 3. to concretize areas of alliance and rules of competition among firms based on the analysis and to suggest outcomes through UML modeling; and 4. to reflect the outcomes of the modeling in the analysis and design of an e-industrial cluster hub system and to suggest examples of the outcomes.

2. Theoretical Investigation

2.1 e-Industrial Cluster Systems as Firm Networks

Williamson[9] understood a network as being positioned between a market and a hierarchical structure, whereas White[8] explained that a market as well as hierarchy is a network. Powell[7] defined a network as an independent structure of governance based on trust. Kim[1] explained, based on Powell's definition, the area where a market and a hierarchical structure overlap with an example of team-based organization within a firm and the area where a network and a market overlap as a network organization that is fast formed and dissolved or a hit-and-run strategic alliance. As the e-business industry undergoes rapid changes in environment and technology, it allows fast formation and disintegration based on relationships of interests and easy strategic alliances centering on new business. An e-cluster hub system exists as a governance structure of firm networks that supports the superiority of such networks at the industry level. The e-industrial cluster complements the concept of the traditional industrial cluster by transcending the boundaries of time and space to support strategic alliances among companies, while establishing transparent and fair rules of competition within an industry to promote systematic and scientific development of that industry and strengthening the industry's international competitiveness.

It can be said that such an e-industrial cluster is a new social phenomenon, as individual industries and IT are being converged and becoming more complex. A case in point can be found in the APEX (Accepted Practice Exchange) program of the U.S., which is promoted by the Convention Industry Council comprising 32 organizations representing the meeting, convention and exhibition industries. The council (http://www.conventionindustry.org/apex/apex.htm) is a program to develop and establish industry-wide recognized standards in order to maximize efficiency of business processes and mutual collaboration in these industries. Because the main functions of this system encompass most information and knowledge necessary for the convention and event industries, including industry standard terms, post-event DB building, event spec guide, accommodation and registration standards, request for proposal, contacts, meeting and site profiles, technical connections with various tourism-related systems, data migration and connection between computers, joint work with partners, adoption of technical standards, recruiting and job-seeking, provision of educational tools, etc., the site serves as a central point of quick and free alliance and collaboration among participating firms. It also enables supply of necessary human resources as well as provision of information and evolved knowledge on standards, thereby performing the actual clustering function of the convention industry. The aim of the e-cluster hub system of the convention industry, the main subject of this study, is to identify the complex relationship of interests among firms within the industry, their various business models and contact points of each participant within a fierce environment of competition and to analyze their needs to create a ground for collaboration through corporate alliance networks and reflect fair rules of competition including disclosure of information on future events into the system, in order to provide a driving force of mid- to long-term industrial development.

2.2 Examination of e-Business Model

The classification criteria of business models suggested by Park[5] – transaction counterpart, types of product, values offered and sales methods – are most commonly used now. This study uses the classification by sales methods among Park's classification criteria and criteria for specific classification suggested by Lee and Kim[4] to comprise a total of 11 specific business models in medium and small segments to accommodate the characteristics of the convention industry, as shown in Table 1

Table 1. Classification of e-Business model segments based on sales methods

Large	Small	Code*
Official business model	Policy support service	BM1
	Official service intermediation	BM2
Sales-type business model	Specialty stores	BM3
	Direct provision of services	BM4
Intermediary-type business model	Services intermediation	BM5
	Commodities intermediation	BM6
Marketing-type business model	Market research and panel	BM7
	Online customer consulting, online views	BM8
Information provision-type business model	Newspapers, magazines, broadcasting	BM9
	Policy reports, consulting	BM10
Community-type business model	Associations and specialized communities	BM11

3. Analysis for Social Networks

The intended goal in the process of designing the strategic alliance models of this study is to propose a direction for strategic alliance of e-business firms that participate in the process in four stages. The following is a brief examination of each stage: first, to extract the relationship between individual firms and business models by inquiring internet-related firms of their current business models and future business models and to examine how individual firms are connected through an analysis of social networks. In addition, by evaluating how strongly individual firms are connected, the network is analyzed by reducing it to include only firms with strong connection. Specific procedures and main elements of each stage are based on research by Park and Kim[6], Kim, et al.[2] and Han and Ohk[3].

4. Case Study

4.1 Analyzing Requirements of Firms in a Convention Hub System

The convention industry by its nature makes it difficult for a firm to perform all processes involving a convention. Therefore, it is a typical industry of inter-firms where several firms are connected with one another centering on their own business models to create added value of the network. As such, it possesses business models related to hosting conventions. A total of 75 firms participated in the establishment of the e-convention industrial cluster hub system; the specific numbers of participating companies and their categories are as follows. Representatives of the firms that participated in the interview for this study are mostly executive-level officers including CEOs, with the lowest level being managers and have a minimum of five years' experience in the convention industry.

Table 2. Composition of participating firms

Category	No.	Category	No.
Government (G*)	1	Hotel (H)	6
Convention center (C)	8	Convention bureau (CV)	7
Travel agency (T)	4	Regional tourism organization (RT)	3
Regional government (RG)	6	PCO (PC)	21
Tourism/convention-related academic organization (R)	7	Korea Convention Bureau (KCV)	1
Airliner (AR)	2	Researcher (R)	3
Various civil associations (TA)	5	Total	75

4.2 The Result of the Analysis of Social Networks

In this paper, the business models of the firms participating in the establishment of the e-convention industrial cluster hub system are classified into 11 types and the relationships between the firms were analyzed by using the information of individual companies for each type. Figure 1 describes how individual firms are forging alliances with and competing against one another through current business models. Figure 2 show the networks of mutual alliance among firms. It can be confirmed that a large number of companies are connected through highly complicated relationships of interests and that business models of PCOs, convention centers and travel agencies in the private sector have particularly complicated mutual relationships. What is interesting here is that the network of cooperation among firms is either connected as TA2-R1-S1-RG1-PC7-C3-CV4-H4 or T1-H6-CV2-C2.

In network analysis, the capability of hub measured by degree of centrality means the ratio of the node number linked with specified one to the node number that subtracts one (itself) from total node. It means the higher centrality value, the more nodes with itself. We can show as Equation 1.

$$C(n_i) = \frac{\sum_{j}^{n} xij}{n-1} \quad (1)$$

C: Degree centrality of node i,
n: Total number of nodes,
X_{ij}: number of degrees between i and j

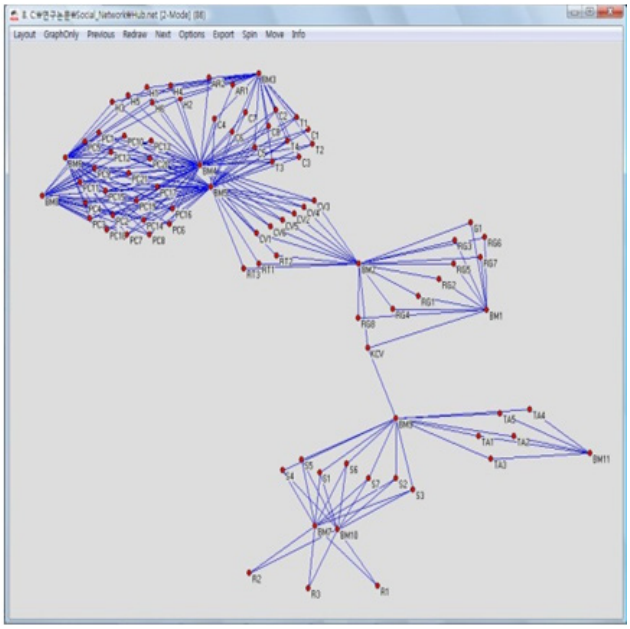

Figure 1. Correlations between Firms.

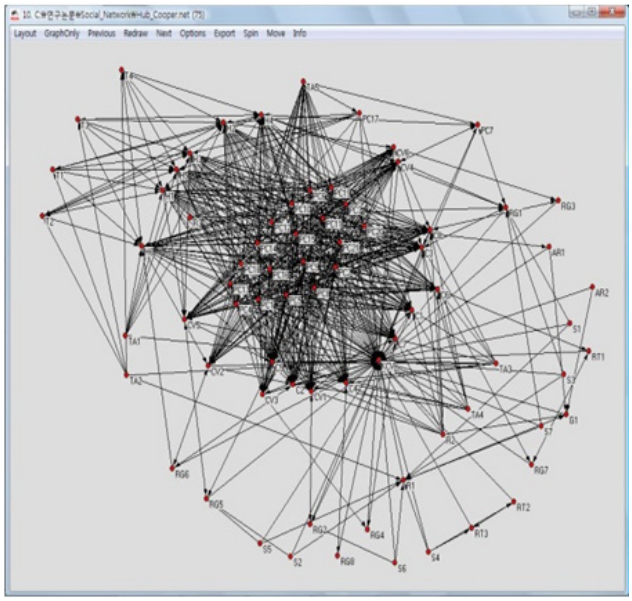

Figure 2. Network of Cooperation between Firms.

Table 4 is a summary of the comparison of degree centrality values of cooperative networks by the type of firms participating in the establishment of the e-convention industrial cluster hub system. The KCB under KTO had the highest value of degree centrality at 0.88 and this is seemingly attributable to the fact that the Bureau has performed such important tasks as statistical surveys, publication of information and data, project support and provision of information on overseas convention hosting. Next, convention centers are found to have the second highest degree centrality value at 0.6, followed by PCOs at 0.58. These three types of firms, which are major participating firms in the convention industry are found to perform major hub functions within the cooperative networks among firms.

Next, the betweeness centrality value was evaluated in order to examine the level of the broker role in the cooperative networks among firms. The betweeness centrality value can be defined as the degree a node must pass through a certain node in order to move on to another node. A higher betweeness centrality value means that it has greater influence over the entire network, as numerically described in Equation 2.

$$B(n_i) = \frac{\sum_{j<k}^{n} z_{jk}(n_i)/z_{jk}}{(n-1)(n-2)/2} \quad (2)$$

$B(n_i)$: The betweeness centrality value of node i,
Z_{jk} (n_i): the number of cases when passing through node i when j and k are connected with the shortest path,
Z: shortest path matrix

Table 3 shows the outcomes of the analysis of betweeness centrality values using the equation above. It was found that the KCB under KTO had the highest betweeness centrality at 0.7, followed by tourism/convention-related associations at 0.06, and then hotels at 0.01. There is an overwhelming difference between the KCB and other firm types, suggesting that if other companies wish to cooperate within the convention industry network, the fastest way to achieve their goal is through the KCB. In order to strategically utilize such a position of networks, it is critical for the KCB to have roles and functions to provide information on which inter-firm alliance networks can be based and to support the convention industry so that a network of added value can be formed. Therefore, considering the degree centrality value and the betweeness centrality value, it is most reasonable for the KCB to take charge of the establishment and operation of the e-convention industrial cluster hub system, given the inter-firm cooperative networks.

Table 3. Degree centrality value and betweeness centrality value of firm networks

Type of Participating Firm	Degree Centrality Value	Betweeness Centrality Value
Ministry of Culture and Tourism	0.48366	0.0003
Convention centers	0.599029	0.0089
Travel agencies	0.432749	0.0041
Researchers	0.506225	0.0003
Regional governments	0.486763	0.0010
Academia	0.479191	0.0000
Airliners	0.485502	0.0034
Associations	0.530029	0.0632
Hotels	0.521223	0.0140
Convention bureaus	0.588441	0.0093
Korea Convention Bureau (KCB)	**0.880952**	**0.6967**
Regional tourism organizations	0.477419	0.0000
PCOs	0.580555	0.0008
Average	0.54000	0.0600

4.3 System Analysis using Analysis of Social Networks

Thus far, the study analyzed the relationships between firms, inter-firm cooperative networks and inter-firm competitive networks through business models resulting from the analysis of social networks. The information acquired from this analysis can be summarized as follows: first, the relationships of interests among companies with highly diverse business models are very acute and complicated and as such, it is important to identify the relations of interests among participating firms. Second, the analysis of inter-firm networks centering on their business models revealed that it is only reasonable that the Korea Convention Bureau, which can perform the roles of both a hub and a broker, is the best entity to take charge of establishing and operating the e-convention industrial cluster. Third, the inter-firm cooperative networks are in line with the direction of the value chain and the formation of inter-firm cooperative networks builds added value networks and they can be built and terminated freely at any time. Fourth, the inter-firm competitive networks involve competition of firms of different types, but most involve competition between companies in the same field. It was found that travel agencies, PCOs and hotels are extremely competitive and that competition among inter-regional networks centering on convention centers was severe.

In order to prevent firms from hitching a free ride in this environment of fierce competition and to convert the competitive landscape into a reasonable and fair structure, it is necessary to provide firms participating in the e-convention industrial cluster with incentives. In this sense, it is important to establish a business model to receive information for cooperation to ensure that each firm will obtain information that they need. Table 4 shows outcomes of an analysis on information needed (receiver-side) and information that can be provided (giver-side) for each type of participating firm. Examination of the information needed and the information that can be provided reveals that input in one side is connected to input in the other side. Therefore, cooperation among participating firms is desperately needed and it may be a good idea to limit the quantity and quality of information that can be obtained depending on the quantity and quality of the information that can be provided. As for hotels, in particular, while they have accurate data on incentive tourism or data on business conferences, they do not provide such information to outsiders. In this regard, convention-related information that hotels need can be utilized as an incentive for the hotels to disclose their own information.

Figure 3 below illustrates the process of organizing a convention. As shown in the network structure of competition among firms, as convention centers are established in each region, their convention bureaus compete fiercely against one another to host conventions mainly at these centers. As such, there has been growing need to establish systems for faster handling of tasks related to hosting conventions. However, the work processes of different convention bureaus are almost identical and regional governments' financial resources could be wasted due to redundant establishment of such processes. Also, because convention bureaus collect information on conventions hosted and held in Korea and make reports on them and because they may either exaggerate or reduce actual performance due to excessive competition among different regions to host conventions, it is necessary to provide a workflow system designed to manage the process to host conventions in order to obtain accurate information on hosting and holding conventions.

Table 4. Information according to the type of e-Convention industrial cluster firm

Povider Recipient	PCO	CVB	Convention Center	KCVB	Hotel	Mltinational firm	Symposium	Academic foundation
PCO		-Priorty given to operate a convention event	-Priorty given to operate an event	-Convention performance authentication -Convention - related statistics	-Room occupancy informantion -Discount offers	-Info on requests for convention proposal -info on former hosting venues	-Informantion on convention proposals and requests-Info on former hosting venues	-Info on convention groups for academic support-Info on convention plans
CVB	-Convention hosting performance-Info on economic spillover effect		-Convention performance	-Convention - related staistics-Info on convention hosting-Provision of economic spillover effect model	-Convention performance-Info on economic spillover effect-Info on accommodation	-Info on requests proposal-Info on aspiration for hosting-Info on scheduled events-Info on companies	-Info on requests proposa-Info on aspiration for hosting-Info on scheduled events-Info on symposium	-Info on convention groups for academic support-Info on convention plans
Convention Center	-Convention hosting performance	Perffered hosting venue-Info on hosting		-Info on convention hosting-Convention - related staistics	-Provision of info on hotels	-Info on scheduled events-Info on convention scale	-Info on scheduled events-Info on convention scale	-Info on convention groups for academic support-Info on convention plans
KCVB	-Convention hosting performance	-Convention performance-Info on regional tourism	-Convention performance-Info on center		-Info on economic spillover effect-Academic symposium performance-Business conference performance	-Info on hosting performance-Info on aspirations for hosting-Info on convention support business	-Info on hosting performance-Info on aspirations for hosting-Info on convention support business	-Info on convention groups for academic support-Info on convention plans

Hotel	-No. of prospective guests-Duration of prospective stays -Prospective events-Designation of preferred hotel	-Prefferd venue/ accommodation-Info on convention hosting	-Prefferd venue/ accommodation-Info on convention hosting	-Convention-related statistics		-Info on future business convention scale-Info on companies	-Info on future business convention scale-Info on companies
Mltinational firm	-Info on PCO-Convention hosting performance-Proposal for business conference	-Info on local tourism-info on local convention infrastructure	-Info on center-Convention-related performance	-Info on business conference support-Info on Korean tourism	-Info on hotel-Business conference hosting performance		
Symposium	-Info on PCO-Convention hosting performance-Proposal for Symposium	-Info on local tourism-info on local convention infrastructure	-Info on center-Convention-related performance	-Info on business conference support-Info on Korean tourism	-Info on hotel -Symposium hosting performance		
Academic foundation	Info to confirm convention hosting sponsored by the goverment	-Info on local subsidy	-Info to confirm convention hosting sponsored by the goverment	-Info to confirm convention hosting sponsored by the goverment	-Info to confirm hotel plans and convention hosting sponsored by the goverment		-Info to confirm convention hosting sponsored by the goverment

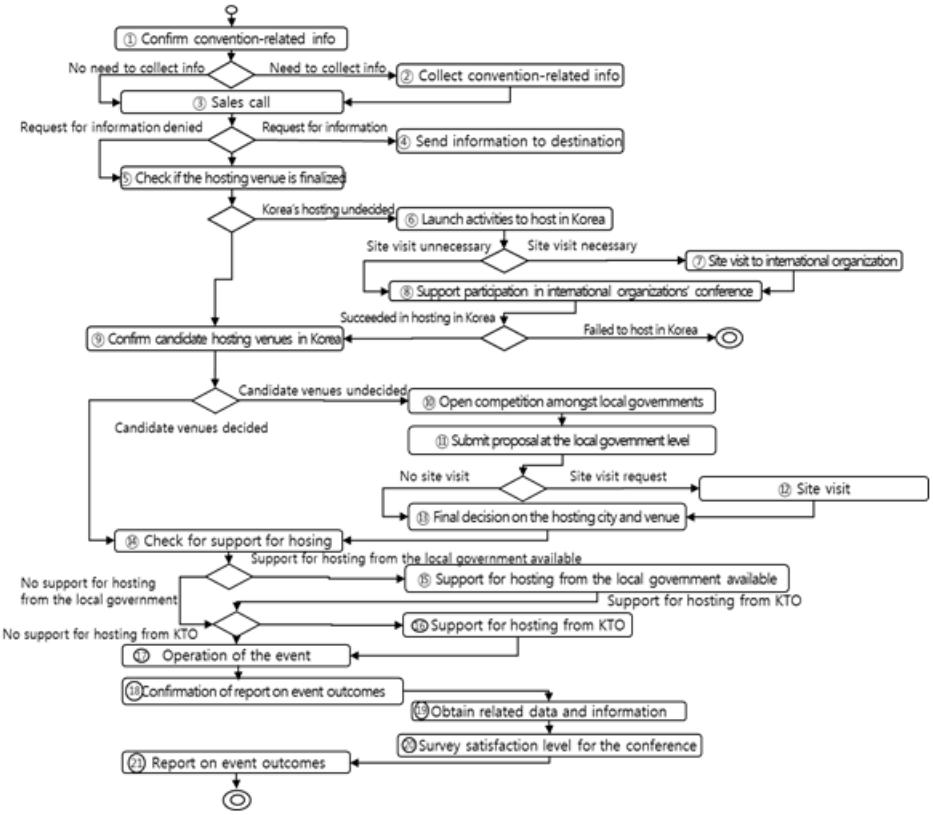

Figure 3. Convention bureau's process to host a convention.

In addition, flexibility to freely expand, modify and add new items on the workflow is needed, as regional governments are cultivating their own specialized festivals and cultural events and the scope of inter-firm networks to be formed to host, hold and carry out conventions varies. Figure 4 below shows each convention bureau's process of handling work, illustrating how each person in charge of each sub-process comprising the process to host conventions manages the work progress.

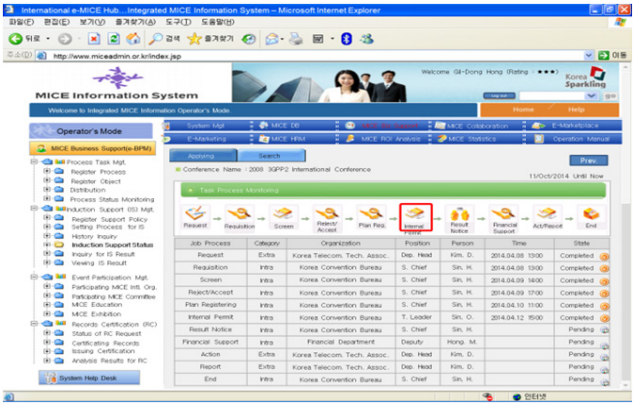

Figure 4. System of workflow to host conventions to induce reasonable competition.

5. Conclusion

Relations between firms, inter-firm, cooperative networks and networks of competition among companies were analyzed in this study through business models that were identified through results of an analysis of social networks. The findings of this study can be summarized as follows: First, because the relationship of interests among firms with various business models is highly acute and complicated, it is crucial to understand the relationship of interests among participating companies. Second, the analysis of inter-firm networks centering on business models revealed that it is reasonable that the Korea Convention Bureau, which can perform the roles of a hub and a broker, is the best entity to take charge of the establishment and operation of the e-convention industrial cluster. Third, the inter-firm, cooperative network is in line with the direction of value chains and the formation of a cooperative network among firms builds a network of added value and the alliance takes a structure that allows free establishment and termination. Fourth, it was also discovered that while the inter-firm, cooperative network may involve competition between

heterogeneous firms, competition among firms in the same business is the largest. In particular, the competition among travel agencies, PCOs and hotels is especially fierce and the competition among corporate networks of a given region centering on convention centers was also intensive.

Based on this analysis, this study suggested the following directions to develop the e-convention industrial cluster hub system. First, a business model that will ensure that the firms must cooperate with one another to obtain the information that they need was suggested in order to prevent free rides and to convert the competition into a fair and reasonable structure amidst this fierce competition. Second, the Korea Convention Bureau under the Korea National Tourism Organization was selected as the main principal of the establishment and operation of the e-convention industrial cluster hub system. Third, a workflow system was provided to manage the convention hosting process in order to support efficient competition between different corporate networks in each region, centering on convention centers. Fourth, the convention application process and performance certification process were combined as a way to compose inter-firm, cooperative networks in a more efficient way. A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

6. Acknowledgement

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2012S1A2A1A01031577) and Dong-Eui University Grant (2012BB022).

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