

Knowledge Management in Inter-Societal Academic R&D

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Abstract—This paper discusses the possibility of using knowledge management tools in the academic collaborative environments that spread across nations. The paper presents the benefits of using knowledge management tools for enhancing the collaborative environment in such academic research, and presents a possible customization of the existing knowledge management tools to arrive at an architecture for such a scenario. The work attempts to resolve that the knowledge management, if appropriately used, will serve as a strong foundation to foster innovation and knowledge creation in universities and among the academia.

Index Terms—Research and development, knowledge management, international collaboration, academia, academic research.

I. INTRODUCTION

This work focuses on trends in inter-societal Knowledge Management (KM) for academic environments. By “inter-societal” we mean a collaborative environment, which cuts across international boundaries/restrictions to pave the way for an environment that encourages innovation and creation of knowledge. We say “*an encouraging environment*” because people from different countries bring in their own cultures and beliefs to the discussion table and such collaborations aid generation of feasible ideas through better brainstorming activities.

The first step in evaluating an international collaborative environment for any purpose would be to identify and appreciate the need for such collaboration. What does collaboration manage to achieve that individualistic approaches don’t? The answer to this question is contextual; however, certain common accomplishments of such efforts include — creation and maintenance of standards, enabling creation and managing of acceptable standards for a variety of processes around the world; division of labor; sharing resources; better risk management; and perhaps one very significant factor of providing better funding opportunities [1]. Collaboration helps achieve all these factors, in addition to some context / domain specific benefits and helps improve the quality of the result of the collaborative work.

In the contemporary competitive world, where every bit of innovation to cause even a fractional amount of

improvement counts, the future for corporations should be one that encourages collaboration. Most of the organizations around the world focusing on research and development (R&D) have realized this fact and have created a culture of achieving better processes through international collaboration. For example, an organization may have its R&D wings spread across some nations, enabling knowledge creation and sharing, and bringing in an influence of multicultural beliefs. The success in such endeavors has meant that the same can be extended to the collaborative education and research among universities and educational institutions.

Knowledge management has been in use in companies for a considerable amount of time now, and has led to better collaboration and better performance of the companies. If this concept is exploited by universities and educational institutions for collaborative R&D, it would contribute to better knowledge diffusion. Though collaboration between institutes across nations would bring up interesting challenges such as intellectual property (IP) rights sharing, ownership, and the like, it still would be appropriate. With KM tools being created to facilitate better collaboration, and knowledge creation/management/sharing, the logical next step would be to integrate KM and the domain of collaborative research.

Most organizations have now integrated KM into their work environments and this acts as one of the major drivers of innovation, however, what is not observed is the same level of acceptance of KM activities or KM tools for the enhancement of research by educational institutes / universities. Collaboration among international universities has been in place for a long time now, and yet almost all such initiatives use conventional methods for supporting their collaboration.

This paper will focus on discussing the current trends in collaboration and use of KM for R&D in corporate and attempts to show that use of KM tools will foster and enhance knowledge creation and sharing, and hence creating a fertile ground for innovation, when used in collaborative environments involving multiple academic institutions or universities from around the world.

II. KM FOR THE COLLABORATIVE R&D ENVIRONMENT

In any nation, R&D growth is a fundamental indicator of the emergence of a knowledge-based economy, promoting future growth in countries, and contributes significantly to the overall economic growth. Collaboration among organizations, typically combining the skills of small and large organizations, leads to the creation of cutting edge technologies. Recent advances in technology have meant

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that remote collaboration is easier, and the Internet has given the flexibility to users to practice “virtual” collaboration.

In an organization, a combination of skills, technologies and disciplines is necessary to bring about innovation, and innovation being a complex process, collaboration helps in risk sharing among the organizations involved in the collaboration. The Internet has also enabled publishing of digital content on the web, which has eased the process of spreading knowledge globally, by means of online databases of journals and patents.

R&D and innovation are not only academia driven anymore, and the private sector has been increasing its participation in these activities, which has, in a way, changed the entire scenario. Earlier, it used to be academic institutions and government funded R&D organizations that used to have a major say in innovation and research, but, the same space is now shared, and increasingly so, by the private sector companies. With major private sector companies having their branches and partners across the world, a vast majority of them have opted for KM initiatives to aid them in knowledge sharing.

Collaboration among academic institutions from around the world has been in practice for a considerable amount of time now, and this has led to a significant increased number of patents and publications. The changing scenario, and the need for cutting costs for private sector companies, has resulted in collaborations among these companies and academic institutions, and has brought upon us an era where the academia conducts the research, contributes primarily to the creation of new products, and shares the benefits with the private sector companies.

However, governments have also resorted to collaboration, in many cases among governments themselves and in some cases with other organizations / academic institutions, to capitalize on the concept of generation of new knowledge, with less investment from their own side, yet contributing to each others’ development. Almost all developed / developing nations are indulging in such partnerships for strategic gains [2].

A challenging task though, is managing the R&D collaboration. Ross Armbrrecht Jr. et. al. [3] identify that knowledge cannot be “managed” in any organization, and instead the focus must be on facilitating and regulating the knowledge flow in the organization. They present the analogy of the flow of a river, and compare knowledge flow to that. Just as the flow of a river can be regulated by building dams, locks, and proper-continuous flow can be ensured by allowing tributaries to join the river and making sure that the river banks are not washed away, the knowledge flow in an organization has to be regulated to derive maximum benefit out of it.

Knowledge management is largely a people-dependent activity and thus, it is wise to acknowledge that people and their interaction creates knowledge. Hence, the culture of an organization always plays a central role in achieving success in KM activities. Many R&D managers have admitted to the realism that most issues in R&D were related to the culture and optimum use of the company’s internal knowledge base. Some issues included prioritizing tasks such as addressing the culture that facilitates knowledge flow, capturing the

knowledge of experts/people leaving the organizations, accelerating R&D process, among others.

Knowledge flow in organizations always includes people and the best KM efforts must focus on enabling this knowledge flow than managing it. This enabling of knowledge flow can be achieved by three key parameters — organizational culture, infrastructure and technology. Organizational culture is one of the primary enablers of knowledge flow since it decides people’s behavior, their daily life at the organization and interpersonal relationships, thereby contributing primarily to knowledge flow. This culture is influenced by management actions, priorities, incentive programs, performance measurement, etc. However, most people find it hard to understand the actual KM programs, and find the concept to be fuzzy.

Ross Armbrrecht Jr. et. al. [3] also identify six imperatives for successful integration of KM with R&D activities, which include:

- Instilling the goals strategies of the organization in the employees, identifying that KM is a people-dependent activity.
- Enhancing the access to the tacit knowledge in the organization.
- Providing search and retrieve tools for retrieving information both internal and external to the organization.
- Promoting creativity in the organization.
- Capturing new learning for future re-use; and,
- Providing a supportive organizational culture.

These six goals are the basic goals that need to be addressed for successful implementation of KM in any organization. This said, what can be the situation in academic institutions? Does the situation change? If so, in what ways and how can the essentials identified in private sector organizations be used in academia? These questions are critical to integrating KM with academic R&D activities. In one sense, learning management systems (LMS) that are now increasingly being implemented in many academic institutions in developed/developing nations can be thought of as being the first step towards collaborative research environment, since it facilitates knowledge sharing among students and teachers. LMS helps teachers to communicate with students, share the course materials and related reference materials with the students, while at the same time facilitating communication and interaction among students.

However, when considering a scenario where multiple academic institutions are involved, LMS may not always be an appropriate choice for a number of issues — security of the data, people’s trust issues, ownership of data, among others. Nevertheless, the benefits of using KM in academic environments for R&D are more than the visible issues. We considered the highlights of KM in collaborative environments in this section, and in the next section, we present the benefits of using KM in academic (international-collaborative) R&D environments.

III. BENEFITS OF USING KM FOR COLLABORATIVE ACADEMIC RESEARCH

Collaboration, as we discussed earlier, brings in fresh perspective and helps in making the knowledge creation

process better and more efficient. For many years now, collaboration among peers in academia has been in place, mainly with the intention of working with people who share common interests. Interaction among peers has always been through the use of traditional communication technologies such as letters (in the earliest scenarios), telephones, emails, etc. Hypothetically, let us consider a well known academician at a well known university, working with his team with another academician from another university and his team on a research project. A scenario requiring any member of the team to search for the details of a communication that happened during the conceptual stage of this research, would be next to impossible, considering the possibility of the team member having lost the said email communication or having labeled it under a different name. Had this team made use of a KM tool for their activity, all their communication, whether relevant or not, would be stored in the system, and all the associated documentation of the project would be stored on the system. Searching and retrieving required information would then make collaboration easier, leading to much efficient working conditions. Therefore, the first benefit would be that all data relevant to the collaborative partnership would be in one place, to make the partnership successful.

Now, with such a system being in place, the second – almost connected benefit of this would be the expansion of this partnership between the institutions or universities. Say, if the universities have sponsored the research that has been undertaken by its researchers, then, it is fair enough to say that the universities are stakeholders in that partnership, and with such a KM system in place to manage the knowledge, the universities could exploit this to encourage further research between them, may be in the same department or between other departments or as is seen in the current scenarios, even inter-disciplinary (within the university or between universities). So, this could actually contribute to enhancing the nature of collaboration, and lead to further generation of new knowledge in various disciplines, thereby adding to the knowledge contribution by both universities.

Having considered these two benefits, we now discuss a couple of cases of collaboration environments / KM in R&D in areas such as biology and nuclear physics, and present how it can be applicable in academic R&D as well. In a research related to zoonoses and avian flu [4], it has been identified that the only way for research to yield any acceptable result that could contribute to the creation of cure for the said diseases, is through collaboration and management of the generated knowledge. The diseases in question are a threat to any nation, and to innovate and create usable solutions necessitates inter-disciplinary research, and not all experts from various disciplines are available at any one given place. Hence, international collaboration becomes a necessity. It has been identified that regional and global consortia, and effective collaboration among them, are the critical factors in limiting the impact of these diseases. In the field of nuclear science and research [5], it has been identified that the effective implementation of KM initiatives will avoid unnecessary duplication of research, thereby saving precious time for the organization. The study also identifies that providing the right content to the researchers at the right time is important and sharing of

knowledge, being inculcated in the organizational culture, will support professional development and will encourage its researchers to keep up with new developments in the domain, which will further lead to increased innovation. In the context of R&D, the study identifies that KM is an integrated process to capture the hidden R&D knowledge in various knowledge based activities and resources, transform it into usable knowledge and diffuse it throughout the R&D organization for future use. The study further identifies that KM helps in the acquisition, organization, dissemination and application of knowledge, which all contribute to the increased innovation output of the nuclear R&D organizations.

The case studies presented above emphasize the fact that for an organization to innovate, a collaborative environment where knowledge is shared is a critical factor. With KM enhancing collaboration, and with the focus now shifting back to academic institutions to deliver with innovation, the way ahead would be for them to integrate KM with their research activities. The need for KM is further justified by the fact that the contemporary research environment encourages (and in some ways necessitates) collaboration among peers spread across the world, to come up with new ideas and contribution to knowledge creation. However, when we talk about innovation and collaboration, some important issues need to be considered, and these will be discussed in the next section.

IV. ISSUES FOR INFORMATION MANAGERS

Implementation of KM for academic research environments would open up a number of issues for the associated information managers. We discuss some of these issues in this section, fully aware of the fact that the list of issues is not exhaustive.

A. *Content/Data Integration Issues*

With the tasks being split in such collaborative environments, integration of data becomes critical. The knowledge base of the collaboration should, at any point of time, contain up to date content about the knowledge that is being created in the process. Some of the factors that could influence knowledge integration could be the difference of cultures, style of working, communication styles in the collaborating entities; the fact that the partnership needs to have entities that share the same values yet complement each other, which leads to more knowledge value creation; and, with knowledge being a human concept, i.e. it is generated in the minds of people, sufficient amount of it has to be integrated in the knowledge base to assist in appropriate knowledge sharing, and value creation.

B. *Knowledge Ownership Issues*

Any partnership is a disaster waiting to happen if all possible risk scenarios are not explored and evaluated in the beginning. One very important issue in collaborative R&D environments would be that of who owns the knowledge that is created. Is it either of the organizations, or both collectively, or the one that has contributed significantly (if so, how to measure significant contribution), or the experts in the collaborating teams? These are some of the ownership

issues that the information manager would have to address.

C. Knowledge Capture Issues

Besides the other issues considered, the information manager would also have to value questions related to knowledge capture, such as — what knowledge to capture, from whom to capture, and how much to capture? With small teams in academic research, addressing these issues may not be an actual problem, since the answers would be nearly straightforward. However, the actual knowledge capture would be the problem, as the manager would have to coordinate with the members of the team and ensure that the knowledge that has been created has indeed been captured. This would actually be critical to the success of the KM initiative.

D. Language

Collaborative environments don't necessarily imply that people on either side of the partnership will be comfortable with any one language. If the language of transaction is English, say, then, it is not necessary that all members of the collaborative teams will be comfortable with English. It may lead to issues where any or all members of the team may not be able to communicate effectively, hence, hindering their collaboration. This can, however, be solved by using a KM tool, which supports efficient language translation feature. Though the current language translation applications are not as effective as one might desire, continuing developments in this domain mean that efficient tools are just around the corner.

E. Copyright and Intellectual Property Issues

In the present day, we often see companies involved in legal battles over violation of intellectual property and copyright. If research has been conducted on a domain and has resulted in a significant contribution, it is natural for the organization to apply for a patent in recognition and the patent body granting it if the claim is found to be true. If the result of a research is also claimed by another organization as being its contribution, which is quite possible with many research institutes pursuing research in one domain, this would result in legal issues. Knowledge sharing and collaboration among universities is based on mutual trust and moral values, and if the trust is violated, this could again result in such issues. The information manager therefore, has to carefully manage the knowledge being created / shared by the teams, and ensure that such issues do not occur and the trust is not violated. He/she has to be influential in creating standards that the collaborating entities adhere to and achieve a successful partnership.

F. Security Issues

In any KM scenario, security of the content is one issue that cannot be ignored. Enforcement of security standards, rights management, access control, ensuring integrity and authentication, and confidentiality of select content, is some of the goals that need to be addressed. Who can create and modify the data in the knowledge base, which member of the team has what level of access to the data in the knowledgebase, how are users authenticated and how is their contribution validated, are some critical questions that

the information manager in such a scenario will be faced with.

Fig. 1 illustrates a possible customization of the existing KM environments for the scenario discussed in this paper. The scenario illustrates that certain users (such as the university administrative boards and other users) only have read only access to certain portions of the knowledge base (indicated by unidirectional arrows), while the actual team involved in the project has read and write access to the knowledge base (indicated by bidirectional arrows). The members of the project teams have complete access to the knowledge base and related modules, while the administrative board can access the knowledge base to monitor the progress of the project, and the other users in the university can only access the patents and publications database, which gives a taste of what the collaborative research is about.

For successful implementation of the KM activity, the information manager will have to ensure that adequate attention is provided to these issues and challenges that will arise out of any partnership in general and a partnership that creates new knowledge or innovates in particular. Nevertheless, the benefits of using KM in R&D clearly state that the use of collaborative techniques and tools that aid them will only further the innovative capacity of any institute or organization. Therefore, we would like to end this section saying that any collaborative activity will be successful if the people (entities) involved share common visions and goals, and have the drive to achieve, and integration of KM in such scenarios helps in enhancing the partnership, leading to better yields.

V. DISCUSSION

Even though traditional communication and collaboration technologies have been in practice by the researchers to accomplish their tasks, they too can exploit the benefits that knowledge management offers. Better communication, knowledge sharing, capturing knowledge in one place to be accessible to the stakeholders at their convenience, video conferencing sessions that can be archived for future references, storage of any forms of communication, rights or access management preventing access of sensitive data to people who shouldn't access it, are few of the many benefits knowledge management offers this domain.

Data security in any environment is a necessity in the current digital environment where data stealing and duplication is accelerated and assisted by the ever improving capacity of the Internet. Security is a crucial factor in any knowledge management initiative and technologies that help in achieving better content security in knowledge management environments are readily available in the tools present in the market today, such as rights management, workflow management, access control, identity management, digital signatures, to name a few [6]. If adequate attention is paid to addressing the security issues and the challenges, such collaborations will be built on a strong foundation, and the use of KM tools will only make the partnership stronger and more efficient.

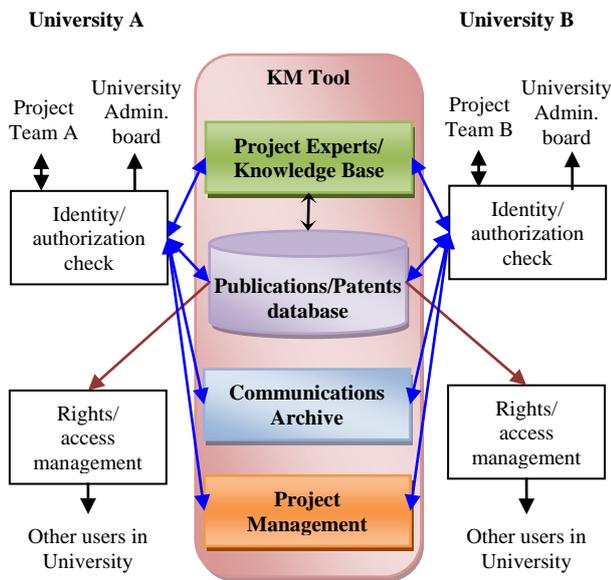


Fig. 1. Illustration of a possible customized model for KM use in international collaborative academic research between two universities.

VI. CONCLUDING REMARKS

KM is a concept that is still in its nascent stages given the fact that it is still not wholeheartedly accepted by everyone in all domains; however, the benefits it offers are aplenty. Nevertheless, the current trends disclose that companies have started embracing KM initiatives to further their yields and increase the efficiency of their business processes.

This work focused on KM for international collaboration in the academic R&D. Diverse and collaborative working environments will require tools such as KM tools to manage data better and efficiently. In research environments, it would create an environment that encourages knowledge sharing and collaboration, and will play a very important role in bringing about a culture of innovation. All said and done, it is about the content that is captured in the knowledge base and new knowledge that is created out of this existing knowledge, and for this purpose, security becomes a crucial element. The role of information managers in the existing and future scenarios will be one where he will have to contribute more in an influential role, than as a controlling authority. This involvement in the knowledge processes with the team will result in an influence on the team instilling the culture that encourages knowledge creation and sharing; at the same time encouraging them to be responsible enough to respect the security procedures in places.

All of this, however, is dependent on the action by the university administration, which make the plans and integrate knowledge management processes. With the benefits of knowledge management out-weighting its drawbacks and the challenges involved in its implementation, we feel that the future might see knowledge management initiatives being integrated into variety of domains, including academic research. Thus, we would like to conclude saying that the future is KM everywhere,

making the processes efficient, contributing to the creation of an international knowledge society that spans across national and political boundaries.

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