WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design and Development of Knowledge Base Web Application 'ज्ञानधारा' for Research Projects at SAC ISRO

Er. Shivam Goswami [1], Dr. Parul Patel [2], Dr. Abha Chhabra [3], Smt. Ankita Patel [4], Rajendra N Gaikwad [5]

[1]Department of Information Technology, UIET CSJM University, Kanpur, Uttar Pradesh-208024
[2,3,4,5] SC/ENG, Space Applications Centre, ISRO, Ahmedabad, Gujarat-380015

Abstract

Project management is a business process for successfully delivering one-of-a kind products and services under real-world time and resource constraints. Developing a project plan, a crucial element of project management, is a difficult task that requires significant experience and expertise. Interestingly, artificial intelligence researchers have developed both mixed-initiative and automated hierarchical planning systems for reducing planning effort and increasing plan evaluation measures. In this paper, we identify this relationship and developed a knowledgebase web application. The main aim of this application is to provide a web-based application for knowledge sharing and knowledge base generation through expertise of SAC Scientists/Engineers. This web application **'ज्ञानधारा'** is developed for SAC in-house research projects and will be hosted at SAC intranet website.

Users can get information about the completed research projects, including objectives, major results/achievements/deliverable/programme linkage etc. The idea is to generate knowledge sharing in tacit and explicit forms and create the knowledge base through crowd sourcing tools. Users can share their ideas/past experience/data/correlated work carried out/similar studies in past/innovative solutions/state of the art knowledge etc. He/She can also provide his/her insights on the new approach or the end result of the project. They can do the above by commenting on the project.

There are also various categories, through which one can view the projects and based on those categories, there are various discussion forums, where all the users can communicate and discuss and can also share their insights. The two different login system, one for the user, and one for the admin. Admin is the sole person responsible for all the projects that are displayed on the User portal. Admin is also responsible to generate statistics and show the same to the User dashboard. Admin is also responsible for all the CRUD (Create, Delete, Update, Delete) operations of the projects. Admin can also block a user for certain time period. All the visuals can be easily handled by the Admin.

This is an Intranet web application; hence all the developed code has been developed in a way that can be accessible without internet to the users. Hence this

crowd sourcing tool provides a platform to share and access different and amazing research ideas, the scientists of SAC have worked on, or are currently working on. There is a most interactive feature which will inspire users of SAC, ISRO for using this web application which is named as "Super Users of the week". The message through pop up modal and listing of users by their contribution ranking will enhance a keen interest on others users too for using such a wonderful web application for knowledge sharing and hence can be treated as a knowledge hub not only for current users but for those who got retired from SAC, ISRO.

1. Introduction

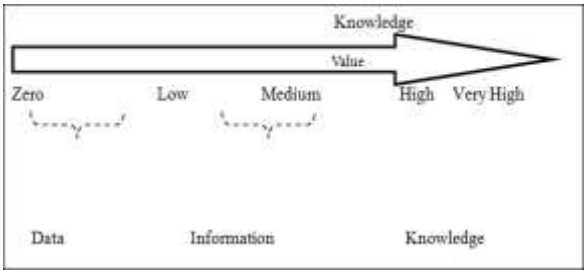
According to Halawi, A.J., Aronson, E.J, and McCarthy, V.R., 2005. [6], the world economy is fast becoming a knowledge-based economy. Knowledge has suddenly become a strategic resource surpassing capital as a source of an organization's competitive advantage if properly managed. As organization's business situations may lead to face different types of challenges which inappropriately decrease the capital. So unique knowledge management solutions are needed to overcome these challenges as well as strategies for sustainable competitive advantage. Organizations need effective means of harnessing knowledge as well as effective knowledge management initiatives and practices. For business organizations to succeed in a knowledge economy there is need for them to understand and appreciate what knowledge is, and effectively manage the Knowledge Management processes of discovery, sharing, and application. With the rapid expansion in the field of scientific research, the ability to find new domain knowledge in the sciences is proving increasingly difficult. Efforts to improve and speed up scientific discovery are being explored on a number of fronts. However, much of this work is based on traditional search and retrieval approaches and the bibliographic citation presentation format remains unchanged. An unfortunate consequence of specialization in the sciences is poor communication across research domains – which can hamper the knowledge discovery process. "Knowledge can be public, yet undiscovered, if independently created fragments are logically related but never retrieved, brought together, and interpreted.

This essential incompleteness of search and retrieval therefore makes possible, and plausible, the existence of undiscovered public knowledge.

2. The Concept of Knowledge

According to Becerra-Fernandez I, (2004) [2], knowledge in an area is justified beliefs about relationships among concepts relevant to that particular area and may be treated as conceptual facts. With consideration in terms of data and information, knowledge is the richest, deepest and most sophisticated yet the most valuable. Knowledge helps produce information from data or more valuable information from less valuable information. The diagram below illustrates how data, information and knowledge relate to each other.

Fig: 2.1 Data, Information and Knowledge



Source: Becerra-Fernandez I, (2004) [2]

Further knowledge can be presented as truths and beliefs, perspectives and concepts, judgments and expectations, methodologies and know- how and is possessed by people, their agents or other activities. Knowledge can be used to collect information and to recognize and identify, scrutinize, give meaning, and evaluate, synthesize and make decisions, plan, implement, monitor the plan, and adapt to the situation. It enables people to act in an intelligent manner. From this we can conclude that knowledge allows ones to determine what a specific situation demands and what is the best way of handling it. Therefore, data feeds into information which in turn feeds into wise decisions which enable humans to find solutions to more sophisticated situations. Managers of organization's are therefore not able to make good decisions that promote organizational effectiveness not because of data but because they are able to use data to create knowledge. The diagram below illustrates this process of turning data to knowledge and their relationship to events.

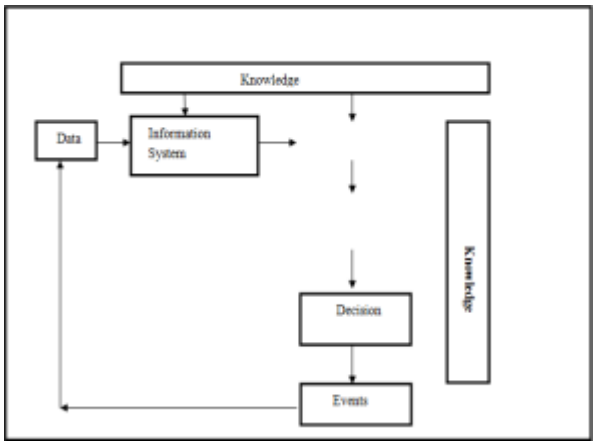


Fig: 2.2 Relating Data, Information and Knowledge to Events

Source: Becerra-Fernandez I, (2004) [2]

Myers, P.S, (2006) [9] gives a broader perspective of organizational knowledge. He describes knowledge as information embedded in routine and process that enable relevant action. It can be correlated with a human quality that resides in the living mind because a person should identify, interpret and internalize knowledge. This means a person should act more intelligently because of the prevalence of knowledge.

According to Davenport, T.H, and Prusak, L, (1998) [5], knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of "the knower". This means not every person in an organization is able to apply himself correctly to organizational processes because of lack of knowledge. In organizations, knowledge often becomes embedded in documents or repositories as well as in organizational routines, processes, practices and norms.

Polanyi, M. (1998) [10] defines knowledge as "that which is known," that is, knowledge being embedded in individuals. He further postulates that only people can know and convert knowing into action, and it is the act of thinking that can transform information into knowledge and create new knowledge. Knowledge involves the link people make between information and its potential application hence knowledge is closer to action than either information or data (Davenport, T.H, and Prusak, L, (1998)) [5].

Uriarte, F.A, (2008) [11] proposed that when information is further processed, it has the potential for becoming knowledge. Information is further processed when one finds a pattern showing a relationship between data and information. And when one is able to realize and understand the patterns and their implications, then this collection of data and information becomes knowledge. He further proposed that whereas mere information is context dependent, knowledge has a tendency to create its own context, that is, the patterns representing knowledge have a tendency to be self-contextualizing. The patterns are complete unlike mere information. This means that knowledge is context-specific unlike information.

Boisot, M.H, (1999) [3] refers to knowledge as assets just like a firm's current and fixed assets. Knowledge assets are stocks of knowledge from which services are expected to flow for a period of time that may be hard to specify in advance just like services flow from current and fixed assets in accounting. Boisot, M.H, (1999) [3] further posits that knowledge builds on information that is extracted from data. Data is discrimination between physical states that may or may not convey information to an agent. Whether it does so or not depend on an agent's prior stock of knowledge. Thus, whereas data can be characterized as a property of things, knowledge is a property of agents predisposing them to act in particular circumstances. In contrast to information, knowledge cannot be directly observed. Its existence can only be inferred from the action of agents.

3. Crowdsourcing

Crowdsourcing is a sourcing model in which individuals or organizations obtain goods and services, including ideas, voting, micro- tasks and finances, from a large, relatively open and often rapidly- evolving group of participants. Currently, crowdsourcing typically involves using the internet to attract and divide work between participants to achieve a cumulative result.

There are major differences between crowdsourcing and outsourcing. Crowdsourcing comes from a less-specific, more public group, whereas outsourcing is commissioned from a specific, named group, and includes a mix of bottom-up and top-down processes. Advantages of using crowdsourcing may include improved costs, speed, quality, flexibility, scalability, or diversity.

Some forms of crowdsourcing, such as in "idea competitions" or "innovation contests" provide ways for organizations to learn beyond the "base of minds" provided by their employees (e.g., LEGO Ideas). Tedious "microtasks" performed in parallel by large, paid crowds (e.g., Amazon Mechanical Turk) are another form of crowdsourcing. It has also been used by not-for-profit organizations and to create common goods (e.g., Wikipedia). The effect of user communication and the platform presentation should be taken into account when evaluating the performance of ideas in crowdsourcing contexts.

A crowdsourcing platform enables solution seekers to use contributions from a group of online users, usually by organizing crowdsourcing contests through which online users contribute to the solution generation process. Knowledge sharing on a crowdsourcing platform could play an important role in the process of crowdsourcing contests and contestants generating high-quality solutions. On one hand, more knowledge resources could lower the participation cost and help improve crowdsourcing outcomes. On the other hand, the shared knowledge may also interrupt contestants' independent solution search processes and limit contestants' creativity. Specifically, knowledge sharing can affect crowdsourcing outcomes via the parallel path effect and stimulating effect in crowdsourcing contests. This study provides an in-depth analysis on how on a crowdsourcing platform the knowledge sharing process impacts contestants' innovation process and contest outcome quality. We first examine how different dimensions of the shared knowledge affect crowdsourcing contests. We find that high knowledge sharing originality negatively impacts the outcome by decreasing the parallel path effect and stimulating effect, while high knowledge sharing quality positively impacts the outcome by increasing the stimulating effect. Subsequent analyses using a finite mixture model indicate that contestants vary in their ways of using knowledge and hence are influenced by knowledge sharing differently.

In recent years, crowdsourcing platforms have become increasingly popular among businesses that seek new ideas for their product and technology development. A tournament-based crowdsourcing platform, such as Kaggle and TopCoder, holds crowdsourcing contests to organize a group of online users who provide solutions to the solution seeker. Online users participate in the crowdsourcing contest and search for solutions independently, and solution seekers select the most satisfactory submissions and offer monetary awards to the winners. Contestants in a crowdsourcing contest compete with each other to win the prize, but at the same time the knowledge sharing process on the platform provides a way of community cooperation. For example, people can have discussions and share information in the online forums on these crowdsourcing platforms. In this paper, we investigate how knowledge sharing on the crowdsourcing platforms impacts crowdsourcing contest outcomes and contestant performance.

Knowledge sharing could play an important role in the process of crowdsourcing contests whose basic aim is to look for high-quality ideas and solutions. Knowledge sharing refers to the provision of information and know-how to help or collaborate with others to develop ideas and solve problems. The knowledge management literature has shown that knowledge sharing can facilitate new product development and improve firm performance (e.g., Hansen, M. T. 2002. [7], Arthur, J. B., & Huntley, C. L. 2005 [1], Collins, C. J., & Smith, K. G. 2006 [4]).

For instance, Kaggle.com, a predictive modeling crowdsourcing platform on which seekers post their data and solvers write code to produce prediction models, features a type of discussion boards called Kernels where people can share coding scripts associated with a contest. The shared coding scripts are for various purposes such as data cleansing, data visualization and algorithm development. On Kaggle Kernels, the coding languages include Julia, Python, R and SQLite.

As the code conveys knowledge directly, sharing coding scripts represents a typical form of knowledge sharing. People may learn from the shared scripts and thus improve their performance, while the other possibility is that the shared scripts distract them and limit their creativity. However, the impact of knowledge sharing may not always be beneficial. Hendriks, P. 1999. [8] argues that the shared knowledge can be augmented only when people truly learn from each other, and knowledge sharing may prove detrimental if inadequate representations of knowledge are transferred among people. The negative effect of knowledge sharing might be more obvious on crowdsourcing platforms, as within a limited time, contestants are supposed to spend as much

effort as possible on working on their own solutions, but participating in and contributing to knowledge sharing could divert the effort. However, even with the possible negative effect, knowledge sharing might still influence crowdsourcing contests in a positive way, since it can facilitate information exchange among contestants and provide knowledge resources to lower contestants' participation costs.

Different dimensions of knowledge sharing may have different effects on crowdsourcing outcomes and contestant performance. Wasko, M. M., & Faraj, S. 2005. [12] study the motivation behind people voluntarily contributing knowledge and helping others through electronic networks. In their work, the knowledge contribution to an online community is measured by the volume of contribution and the helpfulness of the knowledge. Similarly, in this paper we include the originality and quality of the shared knowledge as the focal dimensions. Originality shows the volume of new knowledge shared on the platform. Quality reflects the value and usefulness of the shared knowledge on the platform.

3.1 Alignment in the Components of Crowdsourcing

Before beginning any crowdsourcing activity, researchers need to consider the components of crowdsourcing, each of which plays an integral part in the success of the approach. These components include understanding the research goal, the audience, the engagement mechanism, the platform, and the sensemaking approach.

3.2 Establish the Goal of the Research

The research goal is the first component that should be established by an investigator as they consider crowdsourcing. Clearly articulating the aim of the crowdsourcing initiative before beginning should be considered best practice. As with any goal, we recommend that the goal be concrete, specific, and measurable. By crafting goals with these attributes, the investigator can determine whether or not the approach was successful.

3.3 Define the Target Audience

Once the research goal is established, the audience required to achieve this goal can be defined. Researchers must know their crowd. Depending upon the research goal, specific audience segments may need to be targeted. For example, if the goal is to determine the mail return rates from the United States Census, then researchers will need to target individuals capable of contributing data required to conduct this sort of analysis (e.g., data scientists). Alternatively, if the goal is to collect photographic data on tobacco product placement in retail locations, then researchers will need to target individuals who are willing to do such tasks (e.g., city dwellers who own smartphones and are engaged adequately to visit a variety of stores).

3.4 Identify Suitable Engagement Mechanisms

Knowing the audience will help the research team target recruiting and participation in the crowdsourcing event and inform the crafting of an effective engagement mechanism. This mechanism should be designed to appeal to the likely motivations of individuals within the crowd, encouraging them to take part in the crowdsourcing activities. This is one of the most important steps in the planning process. We have further developed a method for crafting effective engagement mechanisms by extending a simple yet powerful behavioral framework which we discuss in the next section of the paper.

3.5 Determine a Technical Platform to Support Activities

A suitable platform to support the crowdsourcing activities is identified after the researcher has defined the target audience and designed an engagement mechanism. This platform provides a forum for communicating and exchanging value with participants. Selection criteria for a crowdsourcing platform should include the availability of the resource to members of the target audience, the ability to integrate relevant engagement mechanisms to drive ongoing participation, and the means to distribute incentives after completion of the activities.

4. What is Knowledge Base?

A **Knowledge Base** (**KB**) is a technology used to store complex structured and unstructured used by a computer system. The initial use of the term was in connection with expert systems; which were the first knowledge-based systems.

Fig: 2.3 Knowledge Base

Knowledge base is the information repository which handles all the data and uses that data to display to the users as and when required with the requested functions.

4.1 Features of Knowledge Base

- The core objective of knowledgebase platform is to exchange tacit as well as explicit knowledge. It is fulfilling all those objectives.
- Users can upload document and share their comment over specific project and forum.
- User can access analytics of knowledgebase and get updated with graphical representation.
- There is login signup functionality to make website secure from threats.
- Data tables are used to manage list of information such as groups and all the projects, User can search keyword or phrase to find relative results.
- Mailing system is there for user to inform to admin about any bugs etc.
- User can create their own forum under specific project by submitting forum name, group and project.

4.2 Advantages of Knowledge Base

- There is easy flow for tacit and explicit knowledge sharing over specific project.
- Project may get some out of box development, which can be done by other scientist who may not be part of it.
- Scientist can utilize their true potential of knowledge to correct direction with knowledgebase medium.
- Graphical analytics will guide user as well as admins to analyze knowledgebase ecosystem.
- Scientist will able to access all the completed projects and he/she can improve project as well as learn by reading project details.

5. Introduction to System

The main objective of this Knowledge Base Forum is to provide a platform to the users that share the same firm, to go in depth of the research projects handled at their premises and to also provide explicit knowledge that they hold. There are two different modules of the system. A) Admin B) User. The admin module is responsible for all the data that is shown on the user module, along with managing the photographs shown on the portal. The user module can join different groups and are able to communicate with their fellow mates from the different department, and also can provide explicit knowledge to the tacit knowledge by the admin. This is Knowledge Base Forum that will show the research projects that were/are handled by SAC and also provides a medium to share more information to the author and are able to perform more discussions.

6. Scope of System

The Space Research Centre (SAC) located in Ahmedabad, aims towards developing space borne instruments and developing space technologies for the development of the nation. All the members of this institution are dedicated towards achieving the same goal. SAC for many years has provided solutions for communication, broadcasting, navigation, disaster monitoring, meteorology, oceanography, environment monitoring, and natural remote sensing. In order to accomplish these goals SAC has been working on numerous Technology Development Programs (TDP) and Research & Development (R&D).

1. **The proposed study aims to investigate the hitherto unexplored potentialities of 'Knowledge Base' for enhanced Research management at SAC.**
2. **Development of 'Knowledge Base metric' for Research Management**

7. Objective of the System

- Conceptualization of introducing 'Knowledge Base' for improved R&D and technological innovation.
- Design and Development of a web enabled Knowledge Base through Crowd sourcing.
- Project Management.
- Intranet Web based system with two different logins.
- Scale back the manual work.
- Increases in knowledge sharing
- Tracks all records of projects
- Adding a new module for downloading PDF format of the project

The main objective of our system is to manage research projects and all the details of the project. This is intranet website with two different login systems. Admin portal manages all the information of the projects and also looks after the CRUD (Create, Read, Update, Delete) operations that are performed on those projects. The user portal can view all those projects that are uploaded by Admin. This works on the national level of project sharing tool hence these increases the knowledge sharing. One can also download the project information to access it offline.

8. Problem Definition

Several features of this system are as follows:

- Projects Data Management
- Crowd Sourcing
- Knowledge sharing
- Project Sharing
- Explicit Knowledge
- Tacit Knowledge
- Explicit and Tacit Statistics
- Project Statistics
- Discussion Forum
- Email Discussion
- Group Joining

9. Knowledge Classification

Expected type of contributed Knowledge	**Origin of contributed knowledge**
Expert committees' comments	Collective tacit intellect
Opinions	Tacit
observations	Tacit
queries	Tacit
remarks	Tacit
graphs	Explicit
illustrations	Explicit
Research papers	Explicit
Documents	Explicit
Tool	Explicit
Design	Explicit
Software module	Explicit
Algorithm	Explicit

Table: 1.1 Knowledge Classification (Tacit/Explicit)

10. Requirement of the System

I) Functional Requirement: Users of the Knowledge Base Forum for Research Projects, namely users and admins, must be provided the subsequent functionality:

a) Create user, admin account

b) Log into the system

c) Manage Profile

d) Navigate through Project Inventory

e) Select a Project

f) Provide feedback on project

g) Express views on project

h) Rate the projects

i) Download PDF Format of Project

j) Provide external document to support their feedback and help author to improvise.

k) Password flag generation

l) Creating groups, generate visuals.

II) Non-Functional Requirement: It consists of following parameters:

a) **Time:** The time period between the booking of a seat and blocking that seat by the system, should be as minimum as possible.

b) **User Friendly:** System should be more user friendly and self-explanatory.

c) **Flexibility:** System should be flexible so future changes can be easily implemented.

d) **Integrity:** Only System Administrator has rights to access the database, not every user can access all the information. Each user will be having rights to access the modules.

11. System Design

Fig: 2.4 Application Dashboard

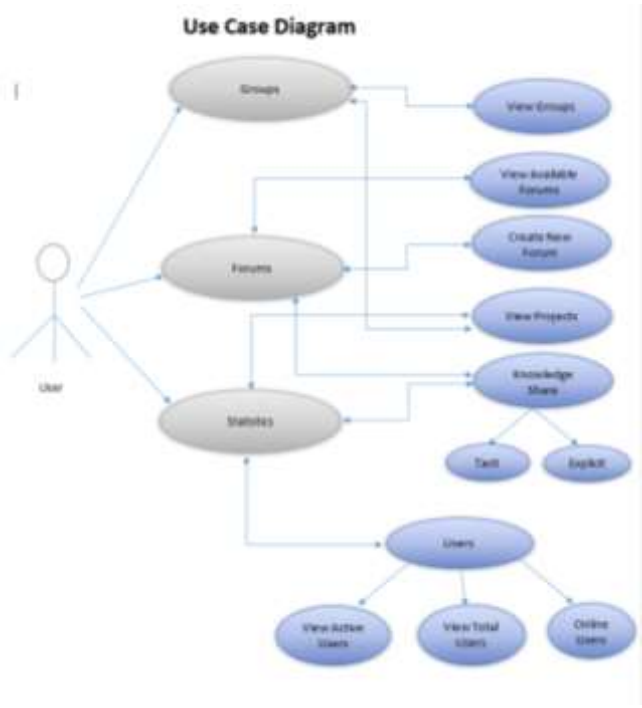


Fig: 2.5 Use Case Diagram

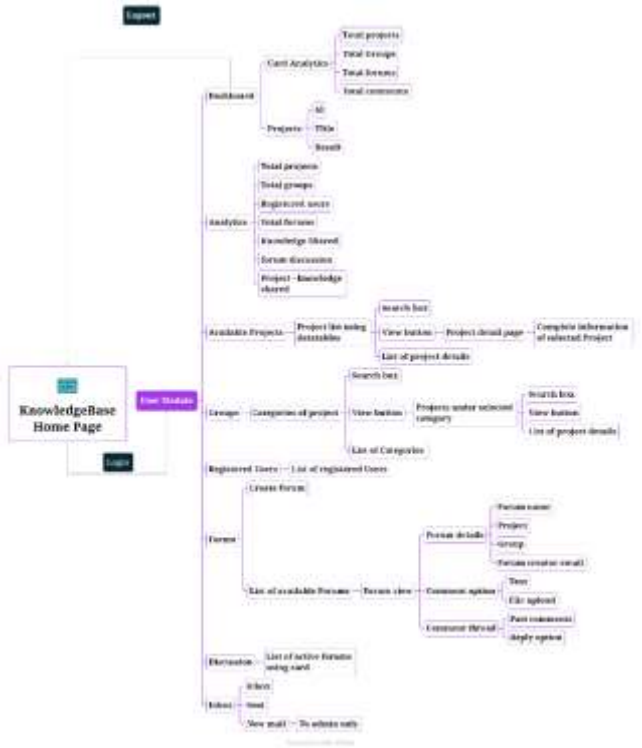


Fig: 2.6 Process Flow Diagram

12. Future Scope

- Populating with more projects database
- Developing with more user visualizations for better statistics and real time analytical tool with deep learning algorithm.

- Integration of Single Sign On facility for SAC Employees with MISD credential.
- Integration of Forgot password request and token generation send by Admin to users Inbox mail.
- Auto deletion of forums having no discussion using machine learning.
- Advancement on Admin Module by Integrating import pdf and word file to database.
- Advancement on Admin Module by Integrating add group, add category, deactivate user, and many more modules.
- Developing with more user visualizations for better statistics and making this platform more attractive.
- Implementing the same system into Mobile based System such as Android and iOS.

Conclusion

This Application will allow scientist over different departments to stand on a platform to communicate, discuss over a different range of topics and share their knowledge with others in various forms like in any textual files (pdf, txt, docx, etc.), any program codes (MATLAB, python, etc.), any previous researches on that topic, any suggestion through comment system and many more features.

This platform will help to add more knowledge and approach to the existing ideas and also help in developing more creative idea and its implementation and hence to generate a knowledge base metric.

References

[1] Arthur, J. B., & Huntley, C. L. 2005. "Ramping up the organizational learning curve: Assessing the impact of deliberate learning on organizational performance under gainsharing," Academy of Management Journal (48:6), pp. 1159-1170.

[2] Becerra-Fernandez I, (2004), Knowledge Management: Challenges, Solutions, and Technologies, New Jersey: Prentice – Hall.

[3] Boisot, M.H, (1999), Knowledge Assets: Securing Competitive Advantage in the Information Economy. Oxford: Oxford University Press.

[4] Collins, C. J., & Smith, K. G. 2006. "Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms," Academy of management journal (49:3), pp. 544-560.

[5] Davenport, T.H, and Prusak, L, (1998), Working Knowledge: How organisations Manage what they know, Harvard Business School Press.

[6] Halawi, A.J., Aronson, E.J, and McCarthy, V.R., 2005. "Resource – based view of Knowledge Management for competitive advantage", *The Electronic Journal of Knowledge Management,* Volume 3, Issue 2, 2005.

[7] Hansen, M. T. 2002. "Knowledge networks: Explaining effective knowledge sharing in multiunit companies," Organization science (13:3), pp. 232-248.

[8] Hendriks, P. 1999. "Why share knowledge? The influence of ICT on the motivation for knowledge sharing," Knowledge and process management (6:2), pp. 91.

[9] Myers, P.S, (2006), Knowledge Management and Organisational Design: An Introduction, Boston: Butterworth- Heinemann.

[10] Polanyi, M. (1998), Personal Knowledge: Towards a Post-Critical Philosophy, London: Routledge and Kegan Paul.

[11] Uriarte, F.A, (2008), Introduction to Knowledge Management, Jakarta: Asean Foundation.

[12] Wasko, M. M., & Faraj, S. 2005. "Why should I share? Examining social capital and knowledge contribution in electronic networks of practice," MIS quarterly, pp. 35-57.