

**Investing in International Information Exchange Activities to Improve the Safety, Cost Effectiveness and Schedule of Cleanup – 13281**

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**ABSTRACT**

With decreasing budgets and increasing pressure on completing cleanup missions as quickly, safely and cost-effectively as possible, there is significant benefit to be gained from collaboration and joint efforts between organizations facing similar issues. With this in mind, the US Department of Energy (DOE) and the UK Nuclear Decommissioning Authority (NDA) have formally agreed to share information on lessons learned on the development and application of new technologies and approaches to improve the safety, cost effectiveness and schedule of the cleanup legacy wastes. To facilitate information exchange a range of tools and methodologies were established. These included tacit knowledge exchange through facilitated meetings, conference calls and Site visits as well as explicit knowledge exchange through document sharing and newsletters. A DOE web-based portal has been established to capture these exchanges and add to them via discussion boards. The information exchange is operating at the Government-to-Government strategic level as well as at the Site Contractor level to address both technical and managerial topic areas. This effort has resulted in opening a dialogue and building working relationships. In some areas joint programs of work have been initiated thus saving resource and enabling the parties to leverage off one another's activities. The potential benefits of high quality information exchange are significant, ranging from cost avoidance through identification of an approach to a problem that has been proven elsewhere to cost sharing and joint development of a new technology to address a common problem. The benefits in outcomes significantly outweigh the costs of the process. The applicability of the tools and methods along with the lessons learned regarding some key issues is of use to any organization that wants to improve value for money. In the waste management marketplace, there are a multitude of challenges being addressed by multiple organizations and the effective pooling and exchange of knowledge and experience can only be of benefit to all participants to help complete the cleanup mission more quickly and more cost effectively. This paper examines in detail the tools and processes used to promote information exchange and the progress made to date. It also discusses the challenges and issues involved and proposes recommendations to others who are involved in similar activities.

## **INTRODUCTION**

With decreasing technology development budgets and increasing pressure on completing cleanup missions as quickly and cost-effectively as possible, there is significant benefit to be gained from collaboration and joint efforts between organizations facing similar issues. With this in mind, the US Department of Energy (DOE) and the UK Nuclear Decommissioning Authority (NDA) signed a Statement of Intent (SOI) in March 2007 in which both parties agreed to share information on lessons learned as well as collaborate on the development and application of new technologies and approaches to improve the safety, cost effectiveness and schedule of the cleanup legacy wastes.

Since that time, a number of ‘Topic Area’ discussions have been held, a number of collaborative technical programs started and significant information exchange activities have been completed.

The potential benefits of this relationship are significant, ranging from cost avoidance from identification of an approach to a problem that has been proven elsewhere through to cost sharing and joint development of a new technology to address a common problem.

There is an appreciation that effective information exchange is a labor-intensive process which requires up front investment and delivers both tangible, and intangible benefits. There are multiple obstacles to success that need to be overcome including commercial sensitivities, equitable exchanges and the ‘not invented here’ syndrome and progress is often slower than desired. However, the experience to date is that it only takes one or two successful exchanges or joint initiatives to justify the investment and the greater the number of exchanges the greater the overall benefit.

The particular challenge for this program is the fact that the information exchange needed to operate across organizations. Whilst much has been done within organizations little has been published on extra-organizational processes.

## **INFORMATION EXCHANGE ASSESSMENT**

The first phase of the program was to define what “Information Exchange” means and to develop a plan for implementation of the program.

### **Stakeholder Analysis**

The information exchange program needed to operate across multiple organizations in different geographic locations across country boundaries. The DOE and NDA were the program sponsors but the participants would be drawn for the US and UK Sites at a Government and Contractor level.

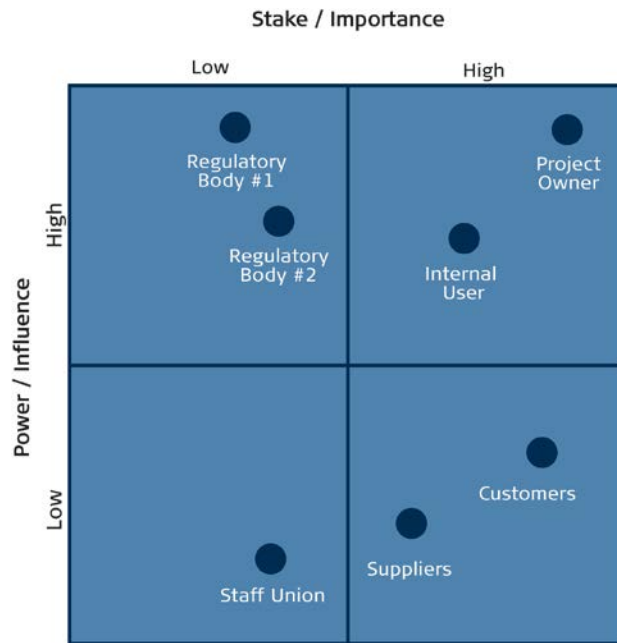


Fig 1: Stakeholder Map

## Requirements Analysis

In initiating the Information Exchange program the different types of need that may be required were considered. The following list examines the choices available:

- **Analysis** - Offering understanding of trends and statistics related to datasets
- **Interpretation** - Understanding concepts and classifying and relating them
- **Abstraction of data** - Producing a simpler view of complex data to help analysis
- **Filing/indexing/classification** - Organizing and storing data in a structured way
- **Searching and filtering** - Information retrieval methods to find relevant data
- **Providing a collaborative/learning environment/facilitation** - encouraging interchange of information, person to person
- **Exchange of data between systems** - Ontology. Enabling smooth communication between different information systems

Although all the areas listed would be valuable to the information exchange program, limited funding required the choice of only one or two of the areas. In the event, “Providing a Collaborative/Learning Environment/Facilitation” was chosen since it was considered the most achievable to implement quickly and with limited funds.

## Topic Areas

In the goal of encouraging interchange of information, there are numerous and varied areas to consider. These were termed “Topic Areas” and the Bummer [1] methodology was used to identify the topic areas that were of most interest to both the DOE and NDA. In brief the methodology was developed to identify joint research networking and consists of four tasks:

Task 1: Solicitation of research issues

Task 2: Assessment of research issues

Task 3: Initial screening of research issues

Task 4: Choosing research issues

A number of one-to-ones and small focus groups were held to solicit the issues and potential topic areas. These took place at the NDA Headquarters in the UK and at the DOE headquarters in the US. This generated a reasonably long list of areas of interest. The regular bilateral meeting held between the DOE and the NDA then determined the topic areas that should be focused on in the first instance.

As a result, the first set of topic areas were as follows:

1. Glass Chemistry
2. Hot Isostatic Pressing
3. Decommissioning and Deactivation (3 sub topics)
  - a. Sodium Passivation
  - b. Decontamination Gel Demonstration
  - c. In Situ Entombment
4. Used Fuel (4 sub topics)
  - a. Fuel Drying and Storage
  - b. Non Standard Fuels
  - c. Ageing Management
  - d. Plutonium Management
5. IX resin Disposal
6. Tank Corrosion and Structural Integrity

These are a combination of highly specific areas and more general areas.

## **KNOWLEDGE TRANSFER PROCESSES**

In determining the processes that were to be used for the topic areas, the emphasis was on two key features: connecting people to people and how to deal with tacit and explicit knowledge. Tacit knowledge, according to Polanyi [2] is a subtle conception rooted in cognitive schemata referred to as “mental models” and is rather difficult to articulate. Another description by Nonaka and Takeuchi [3] is that “tacit knowledge is highly personal and hard to formalize, making it difficult to communicate or to share with others. Subjective insights, intuitions, and hunches fall into this category of knowledge”. On the other hand, explicit knowledge is more easily transmitted as it is characteristically codified. As such, explicit knowledge is more easily processed and shared with others. Nonaka [4] argues that knowledge conversion initiates at the individual level as a “justified true belief” and is expanded through social interactions to include a diversity of perspectives that ultimately represent shared knowledge at the organizational level.

### **Managing Tacit and Explicit Knowledge**

Nonaka and Takeuchi [3] claimed that the emphasis western companies placed on managing knowledge had not been accompanied by an understanding of how it is created. They proposed that organizational knowledge is created through the continuous social interaction of tacit and explicit knowledge involving four sequential modes of knowledge conversion: socialization, externalization, combination and internalization, before returning once more to socialization. This process is a “spiral” one, a metaphor suggesting that each “circuit” builds on the previous one; knowledge creation is also, implicitly, knowledge accumulation

According to the theory, the process of knowledge conversion proceeds through four different modes:

- Socialization (the conversion of tacit knowledge to tacit knowledge);
- Combination (the conversion of explicit knowledge to explicit knowledge);
- Externalization (the conversion of tacit to explicit knowledge); and
- Internalization (the conversion of explicit to tacit knowledge).

Figure 2 depicts this process, sometimes called the SECI model

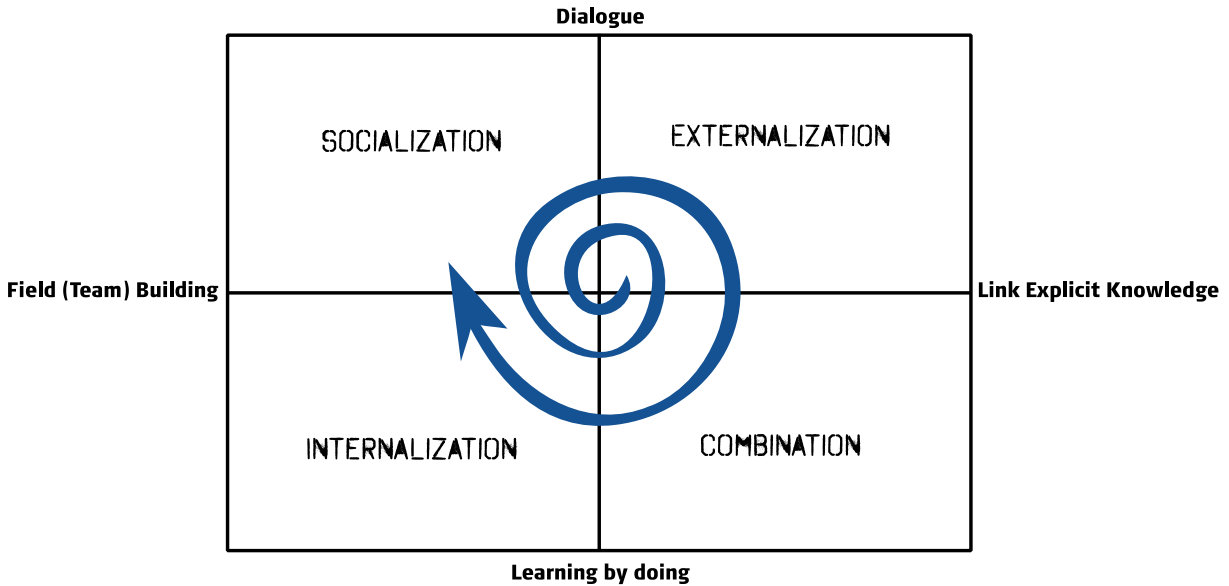


Fig 2: SECI Model

The conclusion from this theory is that there needs to be two basic strategies for managing knowledge - codification and personalization. A codification strategy would focus on capturing, codifying (i.e. making it explicit) and storing knowledge such that others can access it. This is best achieved with information technology and a Portal was developed for this need.

The personalization strategy recognizes that knowledge is closely tied to the person who developed it and is shared mainly through direct person-to-person contacts. The strategy here would be to facilitate those person-to-person interactions.

There is a wide range of communications systems that are readily available for communicating across time and space. Figure 3 below is adapted from Grudin [5] and illustrates the range of tools readily available to the information program. This was achieved using a combination of methods mostly telephone conference calls followed by face-to-face workshops and meetings.

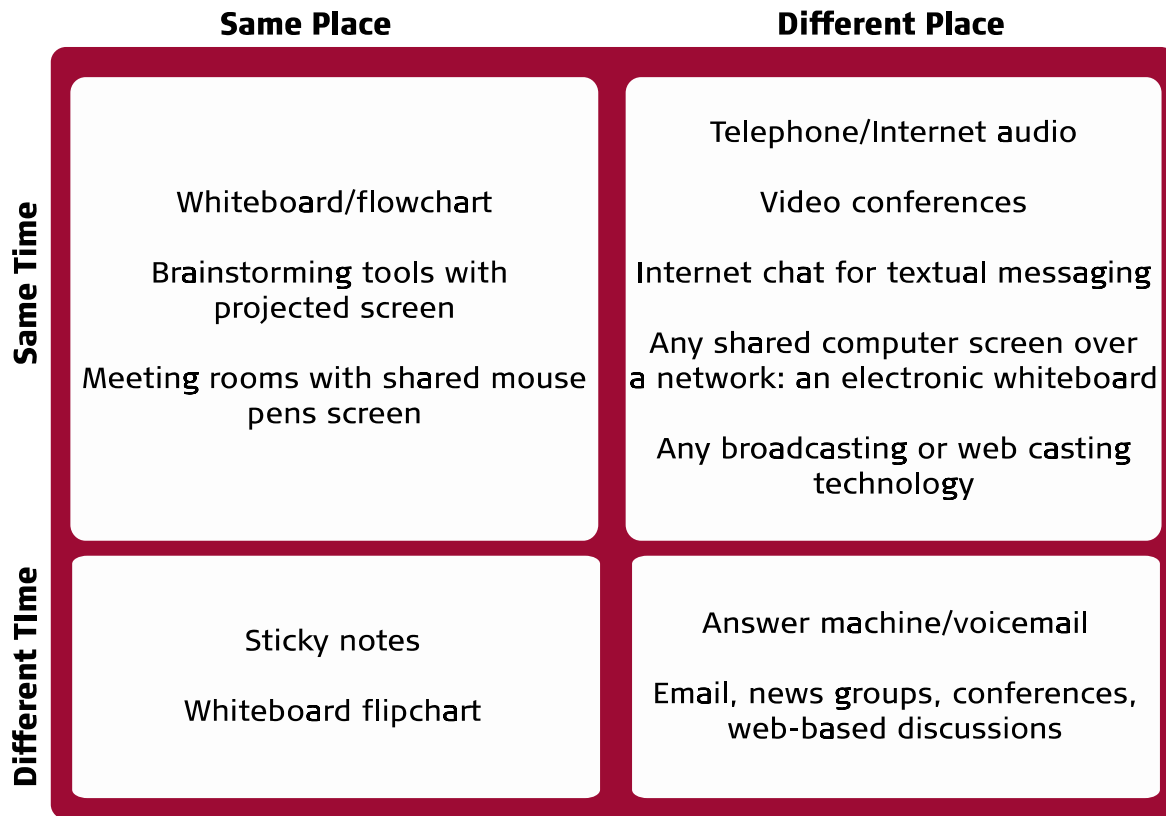


Fig 3: Technologies for Communicating

Using these two strategies a generic process for each topic area was developed. Figure 4 illustrates the personalization activities in blue and the codification activities that lead from them.

For each topic area identified the first step was to identify the individuals who would be involved. This was undertaken by first identifying which person in the DOE and the NDA is accountable for that particular topic. It was then up to them to identify who else should be involved.

The calls were facilitated calls where the DOE and NDA representatives discussed the topic area in more detail. They all followed the same general theme over a number of calls:

- Each side to explain their program in more detail to the other. Identify their major issues.
- Combine information and determine where there were areas of potential interest to both sides.
- Invite additional personnel to calls who had more detailed knowledge of the issues.
- Identify areas where work had already been done and reports shared
- Identify areas where both sides were currently working and there may be potential to

share results, resources, etc.

- If warranted, meet face-to-face in a workshop to identify more detail and work up joint programs.

This process (for each topic area) is represented by the diagram below:

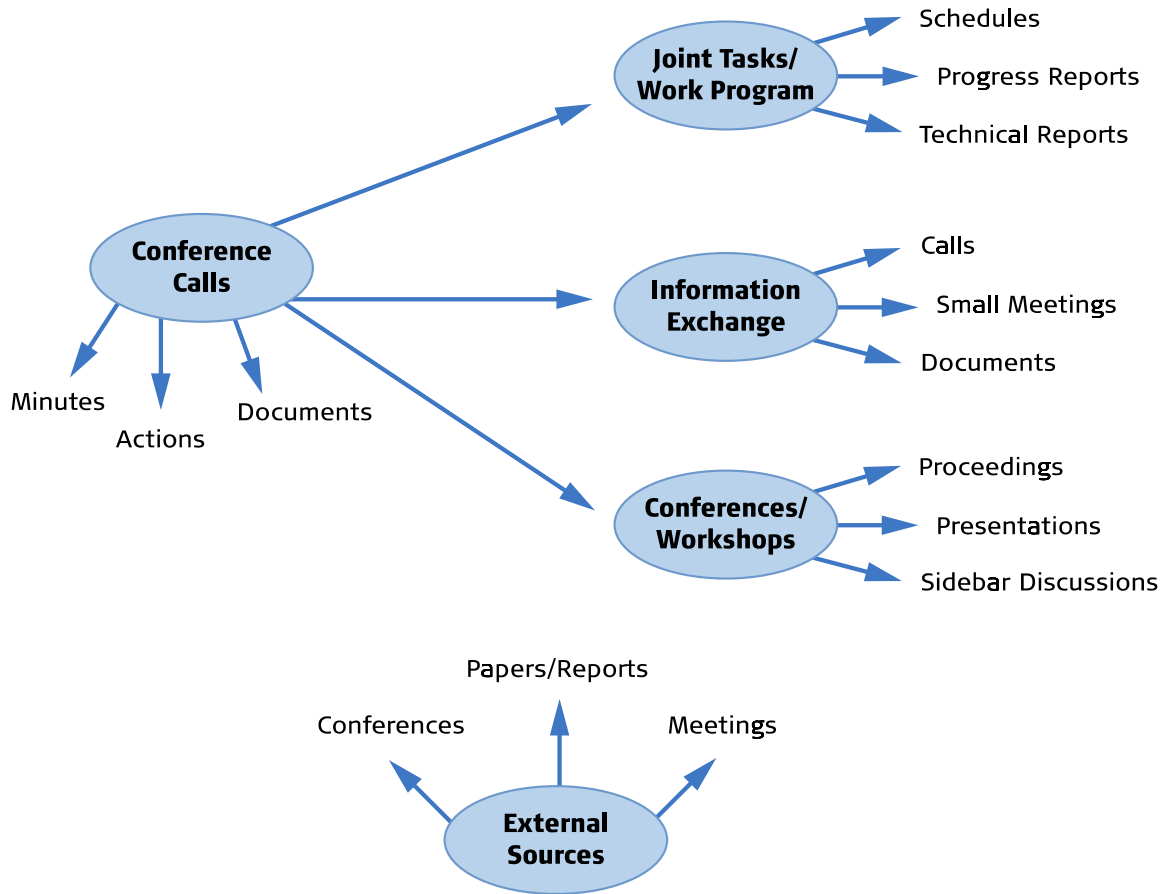


Fig 4: Topic Area Process

## SUSTAINING THE EFFORT

In order for the process to work it requires – in the first instance – a significant degree of facilitation. The participants are in different organizations, in different countries and often in different time zones. Facilitation is needed to bring the right people together and to create a momentum for action. This has been termed “Boundary Spanning” [6] which describes reaching across borders, margins, or sections to 'build relationships, interconnections and



interdependencies in order to manage complex problems. Boundary-spanning individuals develop partnerships and collaboration by 'building sustainable relationships, managing through influence and negotiation, and seeking to understand motives, roles and responsibilities.

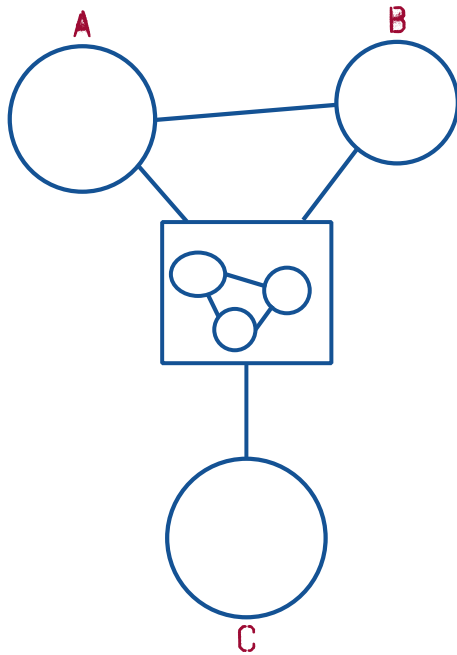


Fig 5: Boundary Spanning

In another sense, “boundary spanning” can be considered to be the energy required to complete a system. Energy is required to be introduced into the systems else nothing will happen. Once it is introduced there is every potential that it will become self-sustaining.

The time and effort required to instigate and perpetuate the workings of each topic area has varied considerably. It is clear that each topic requires considerable effort to get the momentum going and they then move into one of three states: self managing (where the participants are clear about their aims and workscope), close down (where, after debate it is agreed there is no useful advantage to be gained from further calls) and hiatus (where participants continue to believe it is of value but can't agree on a way forward).

It is not possible to either plan a timescale nor to determine beforehand which topic areas fit into which category.

## WHY IT SUCCEEDS OR FAILS

The benefits for information sharing are widespread. Figure 6 illustrates a number of th

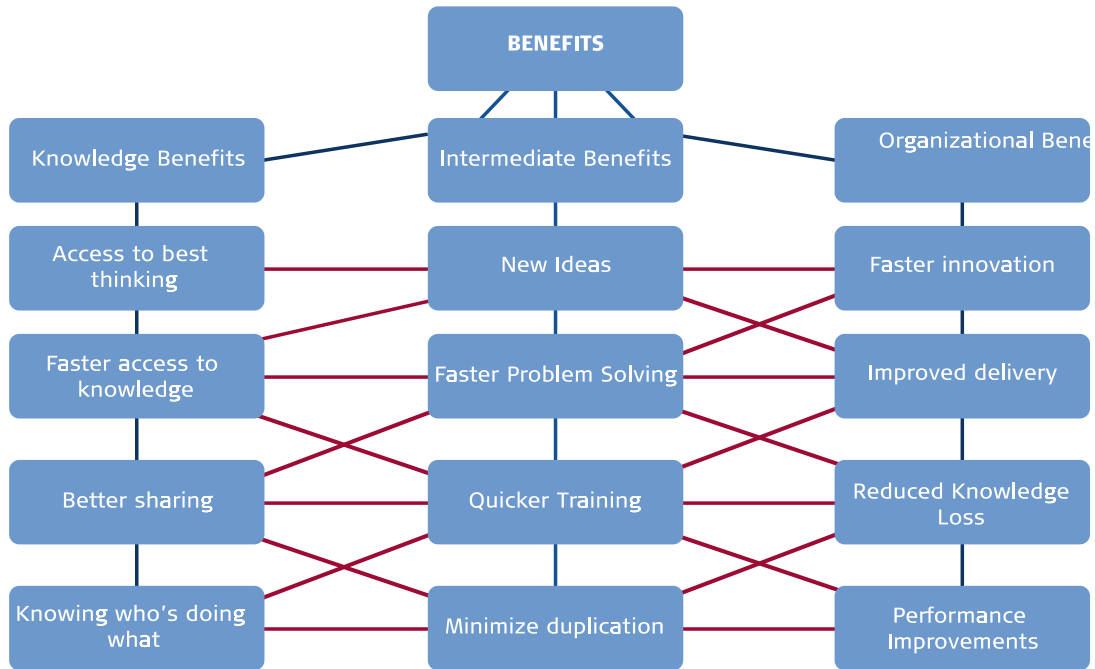
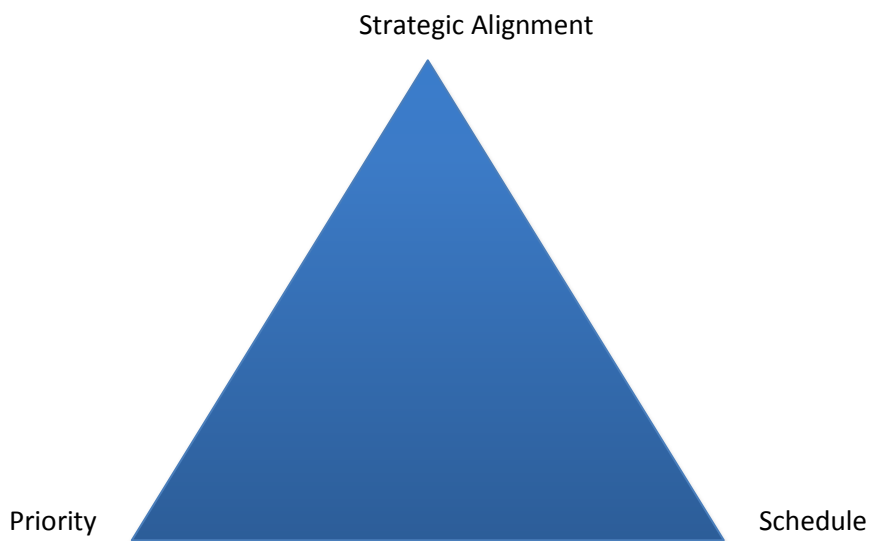


Figure 6: The benefits of knowledge management indicating some interdependencies

From the effort on the program to date, there are a number of factors that will lead to a successful topic area collaboration.

**Leadership.** The most successful topic areas have had strong Leadership from the participants. Often just a single person thoroughly committed will make the difference. Topic Areas with less committed leadership have proven less successful.

**Strategy and Programs.** A clear alignment between Strategy and Programs between the organizations involved is required. In most cases, and certainly where a topic area has been identified, there is a clear alignment of strategy between organizations and all participants have a similar issue. However, the crucial success factor is whether that they are all looking to solve the issue along similar time horizons and that they all place the same priority/importance on it.



Topic areas that meet all these three dimensions more or less fully (for all those involved) will succeed. If any fall short it tends to either close out or go into hiatus.

**Culture.** A culture of sharing, openness and trust is seen in the most successful areas. In many areas the issue of intellectual property rights has been seen and requires additional effort to overcome.

**Time.** Successful topic areas allocate sufficient time over and above the “day job”. All parties see it as being a worthwhile investment.

**Funding.** Successful topic areas allocate an adequate budget. The investment is seen as being relevant and valuable. In addition, the investment for facilitation is a necessary component for all topic areas.

**Facilitation.** Topic areas need an energy source to generate momentum. The concept of “boundary spanning” is essential.

**Processes.** The systematic processes that have been developed allow all topic areas to function in an effective and efficient manner.

**Infrastructure.** Adequate infrastructure is necessary, but it does not require a large investment. Telephone conference calls have worked extremely well. For the codification side, the Information Portal is relatively inexpensive and more than adequate.

## CONCLUSIONS

Information Exchange between the US and UK is now widely acknowledged to be an essential element of the nuclear clean up programs. Both countries have extremely similar programs and hence extremely similar issues. There exists, therefore, considerable potential to learn from each other to enhance program delivery. However, the work being carried out is extremely technical and although many formal reports are produced the real knowledge resides within individuals. It is believed that information exchange through the synthesis of tacit and explicit knowledge is more important than managing knowledge (explicit knowledge). It is clear that the DOE and NDA can benefit from recognizing the power of tacit knowledge creating knowledge through capturing the knowledge embedded in people making it explicit and incorporating synthesized knowledge into key organizational activities.

Through introducing the Information Exchange project we have facilitated the knowledge spiral (the SECI model) and exploited knowledge assets (skills and experiences of high-performing teams). The outcome of the project has contributed to continuous innovation at an organizational level in the US and the UK.

The key lessons are that the process works. It requires time and funding and it isn't possible to identify beforehand which topic areas will be successful. However, a number of success factors have been generated which will help to inform the process going forward.

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