Phased Approach to a Knowledge Management Network

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Abstract: An information-based organisation has a number of repositories to store information of different nature used by different teams and not necessarily interconnected. This leads to a situation in which the information is scattered, duplicated and difficult to access. The ESA KM Team aims to produce an interconnected network of local knowledge units (neurons) which could still produce and store their knowledge using local processes, and at the same time sharing it with the whole network. This paper describes a phased approach to deploy such a solution, which starts by achieving quick wins that bring big benefits at extremely low cost, in view of buying support for the next more demanding phases. Moreover, it is presented an use case in which the approach has been applied, drawing some lessons learned and conclusions from it.

1 INTRODUCTION

The recurring situation in which different departments of the same organisation have different systems and processes to store their information is one of the main challenges to be solved by any Knowledge Management team. The main disadvantages are incompatibility, inefficient and limited access , duplications.

The ESA Knowledge Management team has been dealing with this situation since many years already and even though representatives of different projects or areas agree that a common entry point to ESA knowledge is necessary, the trend is to stick to the usual habits within the team, working over local solutions that are not necessarily integrated into a corporate view.

2 BACKGROUND

In the last decade, the ESA Knowledge Management team has worked on a number of pilot projects that offered different opportunity at identifying and put in place solutions.

One of the main activities in the past was the "KM user days", in which the knowledge management team was in direct contact with the user community from diverse units in order to gather an eclectic set of knowledge related proposals aiming at improving the capturing and sharing of knowledge. The proposal which came as the most urgent, was the creation of a single entry point from where any ESA employee could reach relevant knowledge. The requested knowledge includes: mission documentation, lessons learned, informal content shared by team members, videos from interviews, pictures, lectures and any other types of content that the user would consider interesting either for reuse or simply for corporate culture.

This lead to the development of the ESA Knowledge Management portal, which scope was to gather the mentioned information plus adding a classification on top of the contents and offering a set of services such as calendar or meeting scheduling.

After several years, the same tool went through a number of reviews and further modification according to user requirements and expectations, however still not encountering the expected engagement from the user community. One of the main reasons for this limited success, is perceived due to the existing knowledge that users have stored in other system and the acceptable resistance in migrating data for a not clear benefit. Also, teams that might have been more active in using the new

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- *Knowledge Capture*
  List of videos from lectures and workshops at ESA, some of which are transcribed and searchable with text input
- *Events*
  List of the dates and places of relevant events
- *Lessons Learned*
  General information about the Lessons Learned systems at ESA
- *Expertise Directory*
  A catalogue of experts searchable by a their competencies
- *Knowledge Portfolio*
  Taxonomy from where the user can reach all the knowledge stored in the relevant element in the tree
- *Tools Catalogue*
  A list of tools spread around ESA and editable by the very same users
- *KM Organization in ESA*
  General information about the organization of KM at ESA
- *KM Digital Library*
  A set of digital books extracted from the content within the KM portal
- *Communities*
  User driven sections, where they can add public or private contents and discuss about them with the members.

Figure 1: Main services offered by the **KM Portal**.

tool, would have been demotivated by the fact that the user community (and therefore the sharing of information) was not increasing as expected.

In view of the above results, the approach has been modified; one side, keep an appealing place for the user, where relevant content can be stored, and on the other side, introducing a search capability for finding information traditionally stored in other systems within the organisation.

3 KM VISION

Each project or mission at ESA can be considered an entity producing, storing and accessing their own information, however with the continuous need of accessing the information of each other. Each project would use their own repositories and document management systems. In some cases, the same official platforms is either extended or tailored to a specific mission or project. At the same time, cross fertilization or sharing across projects is achieved by allowing temporary access to each other repository or exchanging documentation.

For KM, the analogy of a "neuron" will serve us appropriately, being a "neuron" an organizational unit or project team that wants to preserve in a more or less standardized way their knowledge, while being able to access the one coming from other neurons.

In this sense, a vision could be to build the "ESA brain" as a network of interconnected neurons where the user could navigate through all ESA knowledge.

4 KM IMPLEMENTATION: PHASED APPROACH

The best balance in cost and obtained results is achieved by a phased approach, allowing to get some important result already during the implementation phase.

There are some advantages to a phased approach:

1. Each neuron will keep its own "identity", which means, it will be tailored to the knowledge needs of the unit.
2. Federated approach, giving to the responsible of each neuron the option to further customize the platform to the needs of the team.
3. The platforms supporting each neuron can reside wherever in the organization, as long as the interface among them is kept.
4. Aligned with ESA culture, which is leaving a certain level of autonomy to the unit. This approach will give to the neuron responsible the control over most of the functionality and content.

The phased approach has been designed with 3 phases, starting with small and low risk activities, however giving quick results and iterating over pilots program until an stable final system is reached.

Even before starting the phased approach, particular attention must be given to identify those missions or projects where the knowledge to be preserved is critical, either due to its uniqueness or to the good value for future activities. Based on this, a number of project/missions will need to be considered for the application of the different phases. The main content of each phase is detailed in Figure 2.

The following section in this paper elaborates further on the area we identified at ESA, on which we followed the phased approach.

Phase 1: *Quick win*
Focus on get the user engagement through easy implemented solutions. Normally the indexing of existing repositories with the search engine will serve that purpose.

Phase 2: *KM tool suite*
Build a KM platform tailored to the unit, keeping at the same time a minimum set common requirements to ensure clear interfaces between all the "neurons" of the network.

Phase 3: *Knowledge network*
Connect all the established neurons to make them visible from each other. This phase is including awareness and support from management to keep growing the knowledge network.

Figure 2: Different phases in the KM implementation.

5 PHASE 1: QUICK WIN

The typical start scenario is the existence of repository of information, embedded in existing process for the recording of information.

The aim of the first phase is to define a scalable and generic solution able to connect existing information from a single place. The adoption of a general purpose search engine is giving a quick solution. The most of the search engine on the market are already customised to the indexing of repository based on common technology and therefore the connection of system can be achieved. by simple customisation.

The acceptance of the user community is facilitated by the fact that with almost no efforts from their side, their knowledge is made available, even without the need of changing their current way of handling their information, since their system can remain unchanged.

The platform embedding the search engine will offer a single starting point to the general user able to search within a big amount of data, normally in an user friendly way and using effective filter capabilities. The same platform offers to the administrator a high ease of use to add file systems or websites to be indexed within a few clicks.

Therefore, the main work of the KM team on this phase would be to identify the information repositories that are currently used by certain units and make them accessible through the search engine.

If the implementation and the awareness of this service is successful, it is to be expected that the disposition of the users toward KM initiatives change positively, so to easy the execution of the next phases. It is important to highlight the need of the support from the user community who will essentially react and being proactive only if seeing immediate benefits.

6 PHASE 2: KM TOOL SUITE

This is the most important part of the process. Normally, if an organizational unit does not have specific KM tool in use, the KM team can provide a tool suite to build a knowledge base, either for capturing a closing program or for supporting a running one. Therefore, once we have applied a quick win solution to the mentioned unit within the organization and gained support from that unit's management team, the next step is to start the second phase.

It is suggested to initiate this phase preparing a formal Project Management Plan, identifying the KM team as the service provider and the interested unit as the customer.

The core services offered by KM have to be defined and implemented taking into account not only the needs of the current project but also scalability and reusability that will enable building a network of interconnected platforms or "neurons". In the first group we would include activities such as:

- Repositories identification (for videos, documents and other sources of information).
- Experts identification and assessment in the competency management (CM) tool.
- Running of interviews.
- Development of a wiki page.

In the second group, certain work that should be common in every KM Tool Suite or "neuron" would involve

- Creation of a knowledge map in the unit.
- Classification of the stored knowledge within that map.
- Standardization of the content types imported in the platform, so they are compatible across the network of "neurons".
- Interfaces with the external search engine.
- Connection of the whole platform to the network of "neurons".

- *Project goal*
  Gather and preserve relevant knowledge of the selected organizational unit
- *Start and end dates*
  Agreed duration for the project
- *Project schedule*
  A detailed chart with the activities, milestones and deliverables for the project
- *Activities and work packages*
  Work packages structure to be followed (highly recommended)
- *Deliverables*
  The main deliverable will be the KM Tool Suite, but other deliverables can be considered, such as a Proof-of-Concept
- *Roles and responsibilities*
  Who is doing what. Eventually reflected in the work packages definition and responsibility.
- *Manpower and financial requirements*
  Financial and manpower commitments

Figure 3: Items included in the project plan .

Also, since the project will involve a considerable amount of activities and systems, we recommend to add Proof-of-Concept milestone that can be presented to the interested team, so they perceive the progress of the KM work and at the same time it reduces the risk of deviations of the expected outcome.

As a further improvement, it could be studied how to deliver the tool suite as a service using cloud technology.

6.1 Requirements for a Layered Design

The explained concept can be successful on the long run only if the main functionality is as independent as possible from the platform and software providing it.

As an example, it shall always be possible to replace the search engine with a different product, might performances or functionalities being an issue, as well as with the knowledge management portal or competency management tools.

With this approach it is ensured an open architecture with the possibility of integrating other systems not foreseen now, guaranteeing that the system stores, classifies and allow access to all the information to be preserved, while at the same time it is decoupled from the implementing platform.

There are certain requirements that any adopted solution must meet:

Element	Requirement
KM Portal	Keep one entry per each knowledge component to be stored, in a standardized format, independently of the original.
KM Portal	Be connectable to the knowledge network in a way that the entries within it are visible from others platforms in the network.
KM Portal	Every element on the architecture shall be either integrated in or accessible from the KM Portal
Knowledge components	Be enabled for classification within the knowledge map.
Knowledge components	Be searchable from the KM Portal.
External search engine	Index every knowledge component that has not an entry in the KM Portal.
External search engine	Be scalable to many interconnected instances.
External search engine	Be integrated in the KM Portal.

Figure 4: High level requirements for a layered design.

7 PHASE 3: KNOWLEDGE NETWORK

The completion of Phase 2 delivers a “neuron”: a platform containing the relevant knowledge of certain organizational unit, capable of being connected to analogous ones in other areas, enabling the user to retrieve information both from their usual unit and from any other external to them.

The work on the Phase 3 has the following objectives:

1. Improve the content classification within the “neuron’s” knowledge base.
2. Assure the correct connection among the different “neurons” in the knowledge network.

3. Outreach and awareness of the developing of the knowledge network. Liaise with potential customers and secure the managerial support within the organization.

The first goal is necessary to ensure that the knowledge map in the "neuron" will be an access point to the stored information, and this is done by tagging each content item with one or many categories within the map. The benefits of such an activity are manifold: by visiting the category X (e.g. "Operational procedures"), the user would get all the content belonging there, be it a document, a video, a lesson learned or even an expert on that area. Also, the system could identify related areas and retrieve results as well, even if they belong to different "neurons" of the network. The only problem with this is that the classification of the content within the map is normally a manual process, very time consuming and need the involvement of the team from the unit implementing the "neuron". Therefore, it must be foreseen already at the beginning of the Phase 2 that after the delivery of the "neuron", the recipient community should work on the classification of the contents within the knowledge map.

Secondly, the resulting "neuron" must be connected to the to the knowledge network and be visible from it. The KM team must ensure and monitor the correct functioning of that connection for keeping a healthy and appealing system to current and future customers.

Finally, the last goal of Phase 3 is to get necessary support both for adding new nodes to the knowledge network in the organization and to maintaining the existing ones. For that purpose, the KM team has to focus on awareness activities, liaising with the stakeholders and potential customers within the organization.

8 USE CASE: ATVCAP

8.1 Introduction

The Automated Transfer Vehicle (ATV) is a mission that has been running at ESA for more than ten years since its conception. It is coming to an end by 2014, leaving behind an enormous amount of knowledge and experiences, from which several areas are of an unique nature and they will be lost if no action is taken to that respect.

Knowing this situation, the KM team contacted the ATV responsible and offered a proposal for a knowledge preservation project. The years of experience of the KM team would be now applied to ATV, covering the following areas:

Technologies. Adapting existing tools as the KM Portal with search engine, wiki, competencies management, knowledge inventories.

Processes. Applying with minimum modifications processes as the ATV knowledge identification, knowledge capture process, competencies management and lessons learned collection and dissemination.

People. Identifying the relevant experts and including them within the Expertise Directory and for reference into the ATV wiki.

Documents. Classifying ATV documentation and applying metadata to ease the searching and for reference into the wiki.

This proposal was conditionally approved, subject to the acceptance of a Proof-of-Concept, resulting in the kick-off of an activity spanning over an entire year and following the phased approach explained below.

8.2 Phase 1: Quick Win

The first steps were aimed to get the buy in of the ATV team. Some existing functionalities were demonstrated such as the KM Portal, the Competency Management tool or a customised wiki and a clear view of how a comprehensive system could be created by a synchronized interaction of such technology applied to the ATV mission. Of particular importance was the demonstration of the existing general purpose search engine, which the KM team decided to use to crawl and index some ATV information sources. The tool could process out of the box, offering in this way a quick and efficient service with real data from the mission.

The principal step was the development of a Proof-of-Concept platform that would demonstrate the possibilities of all the KM tools integrated and working together. This activity was performed during two months with the objective to produce a pilot platform gathering a sample of all the information to retrieve from the ATV mission and to give a flavour of the activities that shall be run during the whole period of ATVCAP.

8.3 Phase 2: KM Tool Suite for ATV

After the acceptance of the Proof-of-Concept, the project called ATVCAP will continue for the rest of the year, with this objective in mind:

To capture, preserve and make available the knowledge, documents, experience, processes and procedures accumulated during the overall lifetime of ATV project.

The ATVCAP project combines the work for the identification, capture and storage of relevant knowledge with the goal of making both explicit and implicit knowledge related to ATV available for different types of customers within ESA. To sum up, the ultimate objective of the project is to capture and make available ATV implicit and explicit knowledge.

The ATVCAP Project Plan is articulated in four main periods:

Planning. This phase consists of ATV technical domains and knowledge areas identification, classification and appraisal, identification of the critical ATV knowledge areas and experts, identification of the customers of ATVCAP, selection of appropriate methodologies and set up necessary KM tools and technologies;

Implementation. This phase consists of customising and deploying the KM Tool Suite, performing knowledge capture events, identifying relevant knowledge, classification of the identified elements and the rolling out of a dedicated search engine.

Evaluation. This phase consists in putting in place mechanisms and procedures for monitoring the project operations and progress to ensure that activities occur as planned, that they remain directed towards the stated objectives, and that appropriate corrective actions are taken if required.

Completion. This phase consists in completing and delivering to ATV project and the other identified customers the tools which have been implemented, users manuals, final reports and other supporting documentation. Final presentation at closure of the project will also be performed.

There are several factors that are key to success:

- Being able to import into the ATV Portal all the knowledge components that the ATV team wants to preserve.
  - To this respect, relevant items were identified: archived documents, videos, lessons learned, experts and software.
  - For each of them, a corresponding entry in the ATV Portal has been chosen, together with the ability to tag each component according to the knowledge map.
- Involvement of the ATV team in the population of the wiki called ATVpedia.
  - The ATVpedia aims at gathering information of the ATV mission at very different level of detail, that will need to be reviewed and approved by the experts from ATV.
- Involvement of the ATV team in the classification of contents within the ATV Portal.
  - As for the ATVpedia, also the categorisation and tagging of the contents must be done under the supervision of the ATV team.

- *Knowledge map*
  ATV knowledge taxonomy.
- *ATV Portal*
  Central entry point of the KM Tool Suite.
- *ATVpedia*
  A wiki that captures the different aspects of the mission not covered by other elements of the suite.
- *Expertise directory*
  Search professionals based on their expertise.
- *Lessons learned*
  ATV lessons learned are categorised in the knowledge map and accessible from the portal.
- *Knowledge capture events*
  Recorded expert interviews for critical topics.
- *Documentation*
  Documentation tagged within the knowledge map.
- *Software*
  Software tagged within the knowledge map.

Figure 5: KM Tool Suite elements for ATV.

8.3.1 ATVCAP System Architecture

The ATV team has defined along way a set of systems to store the information in different ways and according to the expected use within their mission. These include the existing repositories:

- File systems.
- Websites.
- Databases.

However if the same information has to be published outside the project, a more generic access is needed that is not assuming an internal knowledge of the project structure and organisation.

Another goal of ATVCAP is to harmonize the storage of what is considered relevant for the future, therefore, the KM team has to ensure that every piece of knowledge that is considered valuable be kept and classified accordingly.

The achievement of the above goals is obtained by adopting a number of interconnected tools that are accessible by the end user from a single interface: the ATV Portal.

Figure 6: Main sections of the ATV Portal

These generic tools, customized by the KM team for the ATV project, are:

- ATV Portal.
- ATVpedia.
- Search engine.
- Competency Management tool.

It is expected that both systems (ATV existing platforms and ATVCAP) coexist during some time until the ATV mission is reaching the nominal end and the ATVCAP might remain as the official visible interface.

8.4 Phase 3: ATVCAP in a Knowledge Network

After the ATVCAP project is completed, there is a number of steps required to fulfil with the KM vision:

- *Prepare the ATV Portal for the connection to the network of neuron.* Since ATVCAP is the very

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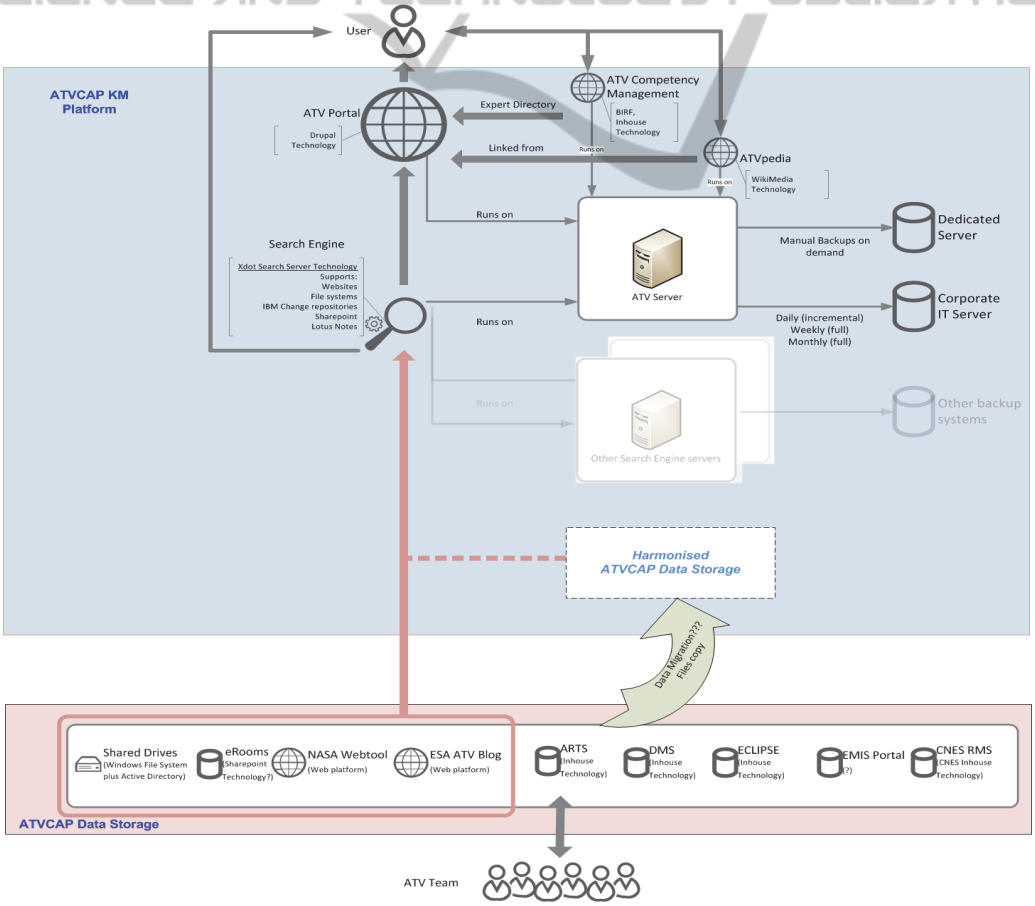

Figure 7: ATVCAP system architecture

first of its kind, it can only be prepared to a future connection. Therefore, the expected activities are the test of the functionality within a mock non-operational network in order to guarantee the correct functioning in the future.

- *Gather user feedback.* The ATVCAP platform has been prepared with enough mechanisms to gather comments and suggestions from the user.
- *Liaise with other organizational units to build new instances of the project and grow the knowledge network.*
- *Evolve the platform to be able to offer it as a service to future customers.* A great step ahead would be the offering of the KM Tool Suite as a service, preparing the core of the functionalities to be installed with a minimum effort. Many examples of this can be found today on many web hosting companies, which deploy a variety of pre-cooked software packages just by a few mouse clicks.
- *Create awareness within ESA.* The KM team has to advertise and promote the KM strategy within the organization so that the approach is presented to the user community. Initiatives like presentations, intranet articles and user day, or ad hoc presentation within already existing information meetings, would help the awareness of the ATVCAP product and the upcoming knowledge network.

9 CONCLUSIONS

After many years, the KM team at ESA, has identified the need to have a single entry point to all the information within the organization. A first attempt was the KM Portal, which did not reach the expected visibility. The analysis performed, using the user feedback, made clear the need of preserving the highly autonomous culture of the Agency: instead of offering a single portal for everyone, each organizational unit shall be left the opportunity of administering their own platform for knowledge, however ensuring access to the information from a centralised place. In this way the requirement of having a single entry point is respected, and at the same time, the processes already established are preserved without impact to the individual projects/units.

The way to build a knowledge network has to follow a phased approach. Starting with a quick-win solution a higher ratio of user engagement is achieved, giving the necessary spin off to continue with the development at a deeper scope. The second phase of the implementation is the most critical. It is a project in itself, a knowledge platform customized to the unit's needs, but at the same time, keeping certain features to guarantee scalability, interfaces and reusability. Finally, the last step of the implementation includes the interconnection of the developed knowledge platform to other similar ones existing already, so each of them can be visible from any node in the network. The monitoring of this system is essential, as it is the continuous liaising and awareness creation, which should assure the growing of the knowledge network until it covers the whole organization.

As an use case, the paper has described the work performed with ATVCAP, a knowledge preservation project for the ATV mission. It is thanks to the success of this project that next steps might be realised with less resistance towards the implementation of a corporate knowledge network.

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