

Lessons Learned Process case study: An Unintended Enabler of Upstream and Downstream Knowledge Management Capabilities at the European Space Agency

Andrew Herd and Francesca Piretti

European Space Agency, Noordwijk, The Netherlands

Andrew.herd@esa.int

Abstract: The paper presents a case study of the European Space Agency which has been coordinating internal knowledge management activities at the corporate level of the Agency for just over 6 years. In this time, previous, current, and future knowledge management activities have been respectively collected, supported, and planned with the immediate intent of addressing potential knowledge loss due to an on-going retirement wave – which will last until 2030. One of the ranges of knowledge management techniques applied is the lessons learned process, with associated means and tools being realised for the capture and exchange of experience. Through the focus on using the validated and evaluated lessons to achieve systematic learning, the lessons learned process has achieved learning at the point of use, rather than mostly keeping the learning within the established Lessons Learned tool, which has also had (unintentionally) caused an enabling effect for other organisational capabilities relating to not only knowledge but also information and data management. The Agency has then made a relatively rapid transition to adopting a systematic approach to Lessons Learned – by both creating the need for (pre-requisite) upstream and “downstream” capabilities. The downstream benefits (learning flowing out of the experience capture) has been achieved by identifying the process, product and people involved in the desired learning outcome, and assuring the learning is placed at this point. In taking the approach of broadening the reach of a traditional lessons learned process (mostly with the aim of more effectively addressing user needs), the establishment of lessons learned capabilities has also enabled the needed upstream development activities for the deployment of lessons learned itself. Aspects such as a solid IT infrastructure (common platform), a robust set of classification terms (taxonomy), and the existence of users with a clear identity (communities of practice). The paper will present the current (but rapidly progressing) status of lessons learned at ESA, and the upstream and downstream effects from the perspective of lessons learned as part of an overall organisational strategy to create a culture and climate of openness and sharing (knowledge management) and digitalisation (information and data management).

Keywords: space agency, lessons learned, case study, benefits

1. Introduction

The European Space Agency (the Agency) has been coordinating knowledge management activities at the corporate level of the Agency for just over 6 years. In this time, previous, current, and future knowledge management activities have been respectively collected, supported, and planned with the immediate intent of addressing potential knowledge loss due to an on-going retirement wave – which will last until 2030. One of the ranges of knowledge management techniques applied is the lessons learned process, with associated novel and innovative means and tools being realised for the capture and exchange of experience [1]. This paper will reflect on the case of the European Space Agency and how internally benefits have been realised outside of the lessons learned process – and how this might apply to other organisation endeavouring to do the same adoption of a lessons learned process.

Lessons learned (LL) provides for the capture and exchange of experience from the projects and activities of the Agency through the creation of a dedicated framework (policy and process documentation) and a web-based tool. The lesson learned process was developed within a well-established organisation with existing ways of working. Indeed, prior attempts to make lessons learned as a beneficial embedded process had not come to fruition (most notably in 2007 when a policy on Lesson Learned was published). The focus on achieving systematic learning through learning actions updating or creating generic or corporate processes, products, or training, has assured the lessons learned process achieved learning at the point of use, and minimised the learning only being retained within the (now) established Lessons Learned portal.

The introduction of a LL new process (conceptually old, but still an innovation in context for the Agency), meant that existing processes were inherently involved and responsible for the success (or failure) of the corporate adoption of this innovation [3]. Considering the lessons learned process as a “black-box”, however not “plug-and-play”, it is possible to consider the needed inputs and the expected outcomes from lessons learned (as a discrete process). This case study considers this approach and, for the benefit of other organisations also

considering undertaking the adoption (deployment) of lessons learned, proposes the possible pre-requisites and the possibility to prepare these enabling capabilities, prior to initiating the adoption process.

2. Research Design

To support this reflection, the concept of upstream and downstream aspects has been introduced to highlight the key aspects forming and being formed as part of lessons learned. “Upstream” aspects are those aspects, capabilities or processes that flow in to (and as such are considered pre-requisites) the lessons learned process. “Downstream” aspects are outcomes of the lessons learned process to beneficiaries or processes (some direct, others indirect). These labels are indicative and not absolute as the paper explores the cross-linkage between upstream and downstream processes.

Having identified these two “axes”, upstream and downstream – an analysis of all involved processes was undertaken within the Agency. These were then mapped against the Lessons Learned process (as the central process) as either inputs or outputs and presented in a mapping type representation.

3. Results

Having gathered the data of what processes were undertaken within the Agency, and how these related to the Lessons Learned process (as the central process) as either inputs or outputs, the resulting mapping was achieved.

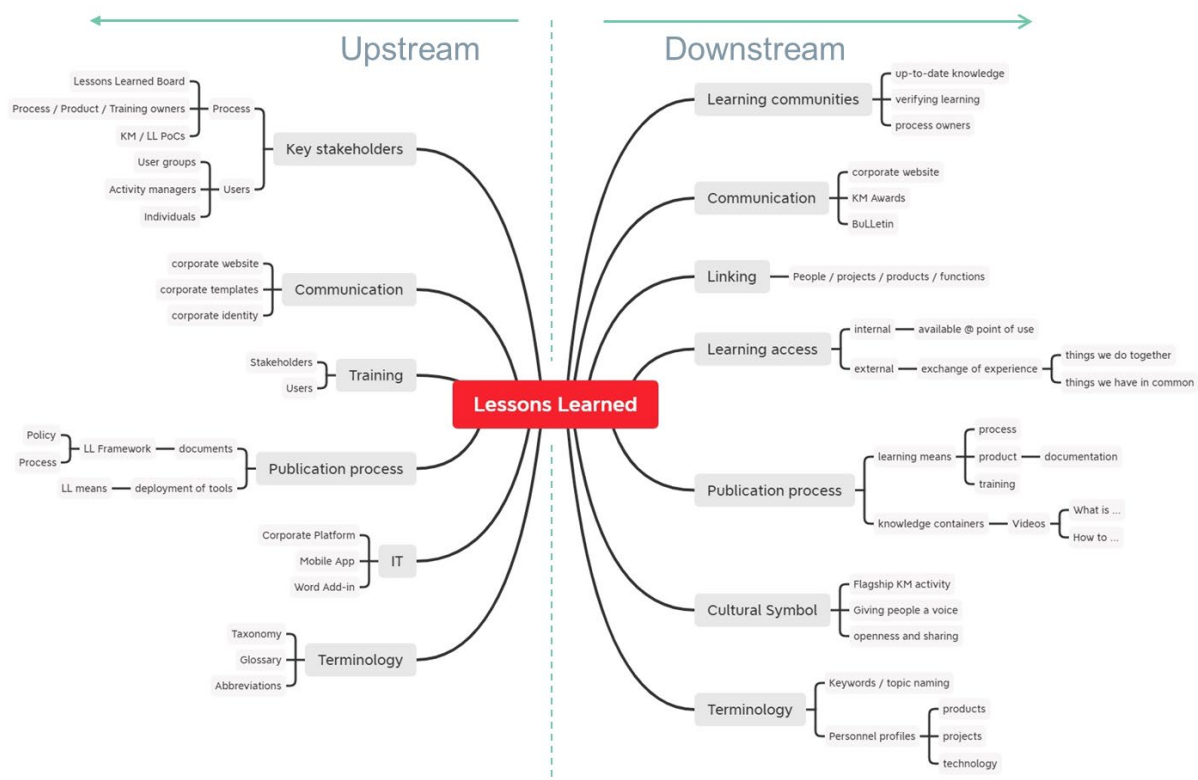


Figure 1.1: Representation of upstream and downstream activities of the Lessons Learned process

4. Discussion

4.1 The upstream benefits

In its most basic form, upstream aspects are the pre-requisites needed for establishing a Lessons Learned process (which can in many ways equally apply to any knowledge management process, or indeed for the support of any innovation adoption within an organisation) and assuring its long-term and effective operation. However, in this section the focus is on Lessons Learned and its direct impact on upstream processes or supporting capabilities. In considering these capabilities as “supporting” this does not diminish their individual contribution or importance towards achieving mission success at the Agency. Indeed, lessons learned itself (as a black box) can be considered as an improvement-based activity (and not fundamental to the organisation, but an optimisation activity). The benefits achieved (and achievable) can go well beyond the initial expectation of

“learning lessons”. In the following sections the use case in the Agency is referred to regarding establishing and operating the Lesson Learned process, means and tools.

4.1.1 Stakeholders

The stakeholders of lessons learned is taken here to mean those involved or directly benefiting from the lessons learned process. These stakeholders can be split into those that assure the lessons process itself is run – “process stakeholders”, and those involved in feeding lessons into the process and those who benefit from the learning outcome of the lessons process – “user stakeholders”. The pre-requisite aspect relates to how these stakeholders are identified, approached and involved, and whether this stakeholder identification and engagement process exists within the organisation. However, in this paper the process stakeholders are put to one side and consider only the stakeholders that are users.

The LL process stakeholders were clearly identified in the Lessons Learned policy document – “who-does-what”. However even though the policy document identified user stakeholders (as those working at the Agency), this was a high-level generic label which in practice needed specific focus and energy to turn into a meaningful and concrete accessible group. There are two aspects, one is identifying what are cohesive groups and the other is then contacting them. In the Agency there are a limited number of these identifiable communities, some of which are more formalised than others (with some preferring an informality of structure, and therefore much more challenging to identify).

When conducting a lesson capture event, it was necessary to identify those who should be involved in each discrete capture event (and this applies across the range of lessons capture techniques applied in the Agency). During the initial capture activities, and upon analysis of the nature of the lessons captured, it became apparent that the function of the participant determines the topic captured. The broader the range of participants (not necessarily the number - i.e., multiple individuals representing a single function, but rather each function being represented), the better the breadth of topic covered. In broadening the scope of participation, lessons learned process itself has then enabled these “peripheral” functions to become better recognised and being included in the activity of changing the way we work by giving their experience given value and their contribution made worthwhile.

4.1.2 Communication

With the introduction of a new corporate process, there is a need to create an awareness of the availability of the capability and to foster the motivation to use it. In organisations where there is an ease of creating new web-based resources, has created is a fundamental need (for effectiveness and efficiency purposes) to assure that these resources are known. With the Agency facing a recruitment wave, there are a significant number of individuals needing to learn where to access and how to use these resources.

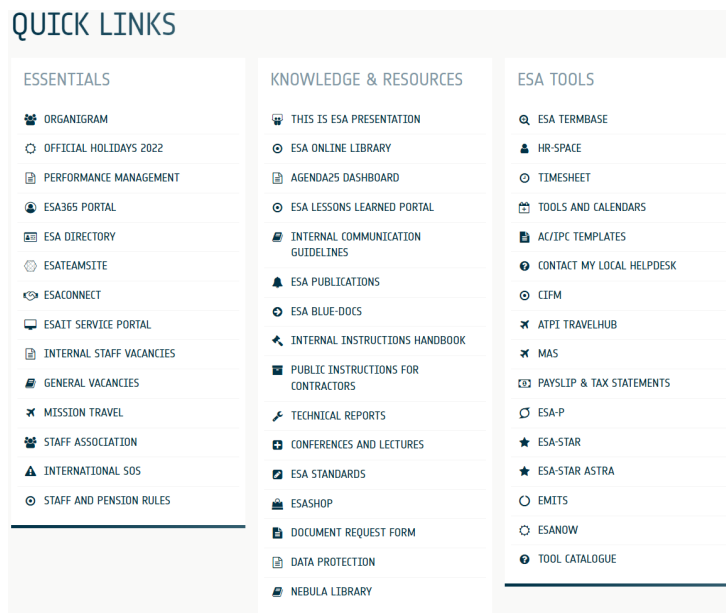
To a significant degree at the corporate level of web-based capability provision, these tools are given on the homepage of the Agency website “OneESA”.

However, it has been established that only around 30% of those working at ESA regularly visit these pages (though some may have already stored the direct weblink to these resources). It is also quoted that corporate push-emails are also read at a level of around 30% of those working at ESA.

The concept of communication then needs to be considered in its broadest sense, for a campaign of awareness of an innovation, tool, capability or benefit to be effectively broadcast and received within the organisation. Communication at the corporate level using corporate capabilities, communication to the discrete stakeholder communities, and during regular status reporting meetings at Boards and Working Group meetings are all an essential part of getting the message across.

To this aim, the use of training and team briefings has also been found to be effective mechanisms to communicate (and transfer) the needed knowledge of and skills to use the enabling capabilities being deployed in the organisation. A campaign of awareness and skills transfer briefing has been systematically undertaken at the Agency to assure that commitments made at the policy level are fulfilled. It is worth noting that initially the commitment to diffuse the KM innovations within the organisation was made, however without effect. To address this an intervention was undertaken where KM briefings were brought to each organisational unit in order to assure the commitment of 100% awareness was achieved. This initiative undertaken within a specific

part of the Agency, has taken some 2 or more years to implement, has evolved with the increased maturity of the new means introduced and more recently moved from awareness (knowledge) of capabilities to also include skills transfer in the briefing sessions. The resulting increased understanding of user stakeholders has in turn prompted an improved dialogue during the briefings and more self-investment oriented questions from users.



4.1.3 Training

With the introduction of a new corporate tool, there is a need to provide the necessary skills to use the tool and to enter the needed data (for capture) and the understanding of how to retrieve experience for the purpose of learning through application. Whilst there was some consideration that tools should be training-free zones (immediately intuitive to all users) this was clearly not an appropriate means to validate a system, mainly due to the different needs and preferences of the wide range of users – what is intuitive to one person is nonsensical to another.

Whilst on the issue of providing appropriate training material for tools use, more recently the focus has shifted towards providing short user videos – called “How to ...” with one short video for each capability the user needs to perform to achieve an effective outcome (capturing or retrieving lessons). These videos are a narrated guided tour of the web-based portal, indicating exactly how to move around the site to perform certain functions. These have been received well and have reduced the number of enquiries about tool-use to the Lessons Learned Secretariat who administer and maintain the tool (and collect and deal with user feedback). This approach of local training resources – with a “help yourself” (in both senses) approach – is novel to the Agency and is now being more widely used and adopted.

On the aspect of having the necessary skillset to use lessons effectively, there is also a need to equip a user with their own mental toolset. One such aspect includes the necessary critical thinking skills. This skill is needed in order for the user to assess where the experience provided was received within a specific context, and if in its raw form the experience or learning needs some transformation into the new application. Knowing when to apply the learning as is, and when not*. This application of the proposed learning can be either adopted (applied without modification) or adapted (applied with modification – specifically to allow the experience to be applied effectively in the new context).

*As the learning actions predominantly result in updates to an existing process product or training, this need for a decision of when to apply literally partially or not at all is removed, and hence critical thinking skills are only needed for the minority of lessons. Having said this, it is now being found that topic or function-based communities are taking it upon themselves to further evaluate lessons and to determine themselves when and how lessons should be learnt (giving learning at a community rather than an individual level).

4.1.4 Publication Process

Differentiating between communication (to people) and publication (deployment of information) is an important part of addressing this specific need. Publication relates to the release of formalised information into the organisational zone (and for lessons learned this is from the corporate or “OneESA” level).

So as an example, publishing the policy and the handbooks developed, needed a formal process (review and approval) to be formally recognised and have (an appropriate level of) authority of content. This formal process not only included the identification of the body through which the documentation would be processed, but also in the choosing of the documentation templates (for example a handbook is only considered a guideline for working). In addition, each body (in this case a Standardisation Board responsible for publishing internal Agency procedures and processes) has its own publications website for the documentation it administers (whilst each document has its own nominated custodian for the maintenance of that document). At the Agency working on a consensus basis means that the review process is also an inherent internal negotiation on how things should be set out and be operated. This is important as it directly determines the level of resources needed to support the process, and to maintain it (and its relevance to evolving ways of working) over the longer term.

With the creation of innovative ways of working, this has also meant that lesson learned processes have evolved (and been more formalised) and have resulted in an update to the documentation set. As such publication process should be seen as a repetitive process (not a permanent process, though) which is needed to establish the framework upon which a lesson learned system is built. Indeed, the internal Quality Management System at ESA, seeks for formalised documents to be revisited every 3 years to assure their effectiveness (and efficiency) of achieving the desired organisational goals.

Publication though also includes the deployment of IT assets – in this case the ESA Lessons Learned Portal. This publication process is somewhat novel at the Agency, resulting in discretion of formality of publication somewhat less defined for applications developed outside of the core Agency IT function. Lesson Learned has fallen in to this category, and so direct involvement of this function has been achieved with an outcome of both being supported by and learning from corporate IT. The aspect of webpage templates however has required a broader involvement outside of corporate IT, as the template for such developments is more loosely defined, and therefore an assessment of a commonality of approach was undertaken to provide a template (of the website) that had the look-and-feel of a corporate application, and provide an appealing interface for the user. The publication process itself does not entail a review process of this look-and-feel – however other aspects are needed and addressed in subsequent sections (for example a tool security certification plan and data protection application process).

4.1.5 Information Technology

To create the necessary capability and to comply fully with ESA Digital Agenda for Space (EDAS), and the aim for the digitalisation of the Agency’s processes and information, documentation and also in the Lesson Learned application the Agency’s knowledge and learning, there was a need to identify the most suitable IT platform on which to build the needed Lessons Learned capability. For IT choices, the corporate IT function provides specific services, and one of the newer services for the Agency (and rapidly evolving in terms of capability) is the provision of Sharepoint platform combined with an ESA-Cloud provision. In order to reinforce the corporate nature of Lessons Learned and fully embed Lessons Learned as a corporate process and means, the Sharepoint platform was chosen as the most suitable. Understanding the limitations of the Sharepoint platform and a perception as a poor user interface, the development of the Lessons Learned portal placed a high emphasis on usability and providing a highly visual experience (classified as the User Experience – or UX) when using the tool.

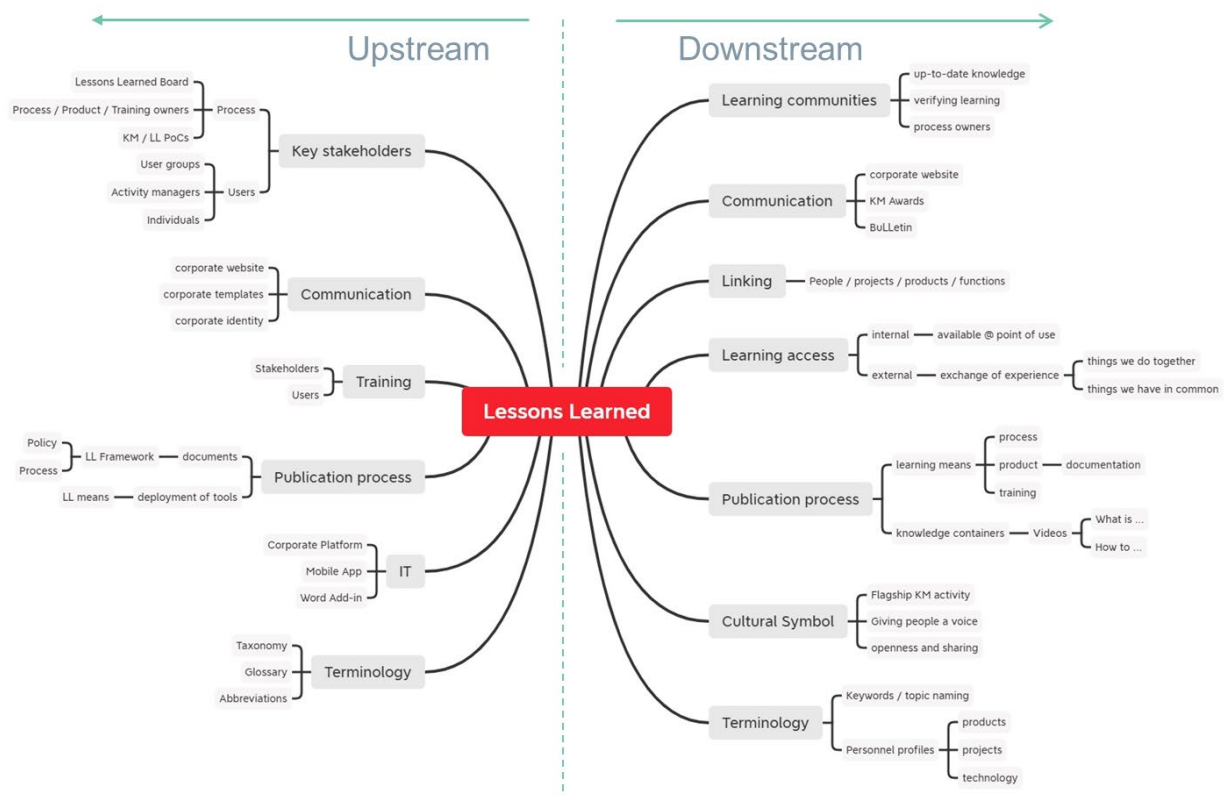
In today’s organisations Information Technology while an enabler for access, this access also brings with it a need for information security and data protection – all of which are then added to or embedded in the IT infrastructure as needed. It is this aspect of controlled access which in terms of climate is a significant conceptual challenge for openness and sharing. The result is controlled sharing within a declared and defined community, i.e., all those working at ESA. As the Agency has a remit from its Member States to also directly support all European space organisations (national space agencies, industry and academia), this aspect of controlled access is being further explored and enabled, in many ways as a ground-breaking activity in Lesson learned - how can the Agency effectively openly and securely share its experience with external parties for the benefit of both parties.

4.1.6 Terminology

To support accurate retrieval, the existence of an agreed set of terminology (at all levels of the organisation) is essential. In an ideal world this would form part of the pre-requisite set prior to embarking on the adoption of the lessons learned innovation within an organisation. ESA does have (and has access to) relevant sets of terms [2] (whether formally classification sets or not) that are appropriately agreed and controlled to allow for adoption within the Lesson tool and the capabilities it provides. As the provision of a standard set of terminology (a set of terms used for classification) is to be embedded in IT tools as a capability, then aspects such as a solid IT infrastructure (common platform), a robust set of classification terms (taxonomy), and the existence of users with a clear identity (communities of practice) commonly co-exist when addressing the introduction of e-capabilities. Lesson learned has been advancing a more systematic approach in the Agency on this aspect, by identifying the need and then pushing for a more integrated rather than instance-specific solutions.

4.2 The downstream benefits

On first reflection the downstream benefits would be considered the outcomes of the lessons learned process – those related to learning. The expected downstream benefits (learning flowing out of the experience capture) has been achieved by identifying the process, product and people involved in the desired learning outcome, and assuring the learning is placed at this point. However, during the application of lessons learned process, the benefits to the Agency have been manifested in a broader manner.



4.2.1 Learning Communities

The identification of learning communities, or more simply groups of experts who have common experience or learning needs is key to disseminating the captured experience into an organisation. The Agency being a bureaucratic organisation has many defined processes, and this has enabled focussing the needed learning to be applied to these already existing processes (and to those who are their custodians). This learning through existing (embedded process) covers around 60% of the experience captured. However outside of these constrained processes, the remaining 40%, are to be learnt through more informal processes, which still can benefit from the experience of others. These processes (in the Agency) still though have a functional responsible, and the learning action in this case is provided to the functional responsible for them to address how the needed learning can be integrated in to specific or generic process. In doing so the connection to these more informal processes with the functional responsible creates the need for the creation of a body-of-thought to assess the needed learning (who will capture, how will it be captured and for whom is it being developed). This helps

communities to be established, and it is not uncommon for these communities to seek for additional learning from the lessons learned system (which in turn leads them to consider capturing their own experience in lessons for others to learn).

It is in these (new) communities that lessons learned is providing *content* for dialogue, a *language* to support the exchange, and the *justification* for that exchange. In addition, in providing content, language and justification lessons have also addressed issues such as cognitive dissonance, justifying decisions to commit resources to learning activities.

4.2.2 Communication

The sense of communication here focusses more on the aspect of promoting the benefits of organisational learning through lessons learned (i.e., demonstrating that a culture and climate of openness and sharing can be achieved, has a positive impact, and relates to the sharer of the experience as much as with the user of that experience).

This has been done both at the corporate level of the Agency, using corporate capabilities such as the internal ESA website (OneESA) to highlight positive outcomes from capture events and through the giving of recognition and celebration for demonstrations of openness and sharing. To complement this the Agency is supporting more local (community-based) types of communication – through the identification or establishment of communities (referred to as Communities of Practice) and then the communication to these groups with a form of informal bulletin. Communication between members of these groups has been facilitated through chat rooms (for the Agency previously “ESA Connect” and now through Microsoft Teams). Some more active (but still informal) communities have created their own news leaflets, whilst for others it is still being established what would be the most effective means (creation and delivery, and, receipt and learning). The aspect of lessons providing content, language and justification also applies as equally in communication as previously stated for communities.

4.2.3 Linking

One of the key downstream (and upstream benefits) of lesson learned as part of knowledge management has been the linking of experts through their process / product or training custodianship to the experience of those undertaking activities or projects at the Agency. Simply, joining the problem (needed learning) to those that have or should have the (need for) solution. So those that own a process are typically not those who are implementing it. This separation then can result in a process, the product that records that process, or the training that assures that the people effecting the process are doing so in an informed and skilled manner, are not “in touch” with the realities of everyday work. Lesson learned has created this link.

In some cases, the need to identify exactly who is responsible for what to set the learning action has provided greater clarity and understanding within the Agency of who does what. To this end, individuals are finding that their roles and the function they provide are better known, appreciated, and understood (and indeed better justified).

The concept of ownership (of the needed learning) is a key part of lessons learned and is a fundamental aspect of being able to systematically assure organisation learning (setting the Agency as a Learning Organisation). In this regard lessons learned has significantly activated process responsables to assess learning needs.

4.2.4 Learning Access

The learning access should be interpreted in the direction of diffusion of organisational learning (through means achieving push to and pull from the users) – be that the organisation from which the experience was derived or indeed an organisation that could benefit from receiving that experience through a learning exchange.

Within the Agency the intent is to create learning at “point-of-use”. This has led to the development and deployment of novel interfaces to support this diffusion. Embedded glossary in Microsoft Word (which needed to approval of the capability to insert Add-Ins), and a mobile app for a formal definitions of space terminology (which needed the agreement on content and template of the Agency shop front of the two primary App stores).

Most access to learning (around 60%) is achieved using embedded documents during the everyday execution of processes. Some learning can be conveyed externally by implication – so requirements levied on an external

party as part of a contract may then transfer inherent learning in the system where this process has been updated by already incorporating the lessons learning. This is however invisible learning as typically the lesson itself is not visible or even reference in that document – and hence the user is unaware they are accessing the learning of the Agency.

4.2.5 Publication Process

The downstream publication differs from the upstream as it is only involved in the assured flow of the learning outcomes into the organisational domain. Typically, this relates to the more formal publication processes used by the process custodians to re-publish their documentation after update to include the learning. This increased overhead of publication can be justified by the value of the knowledge retained within the document and the benefits that are derived through its use.

However, this learning which is in its nature experiential learning is in most cases captured more in an informative sense rather than in a normative one. This is to say that learning seems to be more commonly captured in handbooks than it does in updates to standards (though it has depended upon the subject matter of capture). This impacts publication, as the more formal the document the more formal the publication process, and to use such a formal process (and potentially resource demanding) may not be so appropriate for an informative document – particularly if this document is regularly updated with new experiences. The advantage with the more formal publication process is that they inherently also contain a means to e-publish (such as a web-portal) at a level of organisation wide, as in the case in the Agency. A balance therefore needs to be made, and potentially negotiation with the publishing body itself that these “new” types of products can be flowed effectively through the system, and that the members of this community are aware how to handle such informal documents during the review and publication process.

Lessons learned then has brought to these publication bodies a wider view of what is (needing to be) published and how this is achieved. In addition, more and a broader range of users are now referring to their portal to retrieve documentation.

4.2.6 Cultural symbol

Lesson learned, for multiple reasons, has established itself (through use and benefit) as the flagship of knowledge management. It has engaged a wide range of communities, both upstream and downstream. It has at the various stages of its development, deployment (including means) and operations brought together generic corporate entities (IT, communication, human resources, documentation management and so on). In short it has engaged those working at ESA, not least due to the high attention along this path to both manage user expectations but also each step of the way to pay attention to providing a positive user experience (significantly contributed by requesting and processing post activity feedback).

In addition to this, it has been a significant tool to give those working at ESA a voice in what they do and how it is done. This later part is significant as giving an individual the opportunity to have a stake in changing an organisation, to support the way it is run provides greater buy-in and commitment to that organisation. In valuing their opinion and taking this to the process owners who were previously unaware or unable (having not the content, language nor the justification to act), the Agency has validated its commitment to listen and respond accordingly in the pursuit of its mission.

This latter aspect is also key to demonstrating that, whilst the lesson learned process worked with individuals and seeks for them to be open and share their experiences for the benefit of the Agency, the process owners are equally open to listen to the experiences received and to share the outcome of the incorporation of that experience within the process for which they are custodian

4.2.7 Terminology

In lesson providing a language of communication, it acknowledges the terminology used by those having the experience and matches these with the terminology of those implementing it in the process. This also then applies and influences those retrieving lessons as they are also then bound by using same the terminology.

Traditionally data retrieval has been based on a classic logic of what you put in (i.e., the search term used) you get out (matches the metadata stored alongside the documentation stored) with only the exact matches being produced.

The Agency is exploring capabilities that will extend this capability to match like terms and not only exact terms. This capability is important as even though intelligent search systems might learn what is being requested based on varied terms used, the number of uses in the Agency will always be limited and therefore the rate of learning of an intelligent system be rather (too) slow.

5. Conclusion

When considering the case study and its application at the European Space Agency the methodology proposed would seem to provide credible and constructive insights into the possible inputs (needed) and outputs (expected) when introducing lessons learned into an organisation. However, the validation of whether this approach could be applied to other organisations would require further research (case study-based or otherwise) to check the robustness and consistency of what is being applied and realised at the Agency as also relevant as a generic approach for any other organisation. Influencing aspects to consider (and gather data on) might be the type or size of organisation to which lessons learned is being applied and the age or degree of existence and establishment of the intra-organisational processes, which could be influencing factors affecting to usefulness of this approach.

Regarding the outcome of this case-study research within the Agency, it is interesting to reflect on ISO 30401 (Annex B) it sets out the “adjacent disciplines” to knowledge management. This list of disciplines, information management, data management, business intelligence, customer relationship management, training / learning & development, organizational learning, innovation management and management systems are provided and their separation from knowledge management explored.

It would seem though, on reflection, that this is provided to be able to separate and justify knowledge management as a discrete discipline. Whilst this is not challenged (though change management could have been added to the list, for example) the positive interactions between these disciplines are not explored in the Annex.

Within an organisation, and the Agency is one such, it is all too easy to get overloaded with new initiatives. The list of potential candidates of new initiatives is given in Annex B of the ISO 30401 standard (though there are more – Lean Management as an example). The overload level (at the individual and organisational level) is all too easy to reach, particularly when these adopted initiatives are accompanied by separate processes, means and particularly tools.

During the initial phases of introduction of the lessons learned process at the Agency a question was asked – “will the introduction of knowledge management, solve my information management needs”. At the time, the answer given (by the author) was very much along the lines of Annex B of ISO 30401 – an explanation of what knowledge management is, and, why knowledge management is separate from other management (systems) such as information management.

However, in retrospect, looking at the upstream and downstream benefits of lessons learned as a key (and flagship) knowledge management process realised at the Agency, the answer probably should have been a simple “yes”.

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