

An enterprise innovation: University of Reading Video Publishing System

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1. ABSTRACT

Technology innovation in universities can be formidable tasks due to size of user base, the increasing distance between campus and students, but also increasing proximity that technologies such as video could establish.

University of Reading, UK, having invested in smaller installations Helix and iTunesU, then decided to implement an enterprise-level transcoding and publishing system. The process faced many challenges. The passion and commitment from a core community provided enough impetus for senior management to move the project forward. A major innovation process ensued which saw further engagements from increasingly more and diverse users. By championing best practice and demonstrating excellence in technology, entrepreneurship that is fundamental for successful innovation, this paper demonstrates evidence of excellence in many ways. The innovation remains operational and is sustaining high use with very few issues and problems for over four years. The paper suggests methodologies that others could consider in their own innovation.

2. BACKGROUND

Universities have been seats of technological innovation and entrepreneurship in recent decades, e.g. industrial partnership, start-ups. There have also been many internal technological innovations within such institutions, e.g. research in network protocols which led to the internet in the 1990s, as well as the configuration of commercial enterprise applications, e.g. email. Knowledge and entrepreneurship are two factors that enabled many technology personnel to understand the problem or limitation of a given product or service, develop the interest and passion to evaluate possible options, implement the accepted solution and continue with service improvement thereafter.

This paper analyses the innovative efforts that created the video publishing system (VPS) in the University of Reading (UoR), UK. It is a journey of discovery in technological implementation, organizational culture, vision and strategy formulation, and strategic alliance. The paper will discuss VPS benefits to UoR, innovation and efficiency gain, collaboration, imagination, technological integration and transferability.

Internal to UoR, the VPS project name is AV Dropbox (short for audio-visual dropbox) as it transcodes audio and video files (as Figure 2 shows). The name remains so today. This paper refers to the video part being the majority of the innovation, and uses VPS to avoid confusion.

The university's Marketing, Communication and Engagement (MCE) decided, having consulted with IT Services (ITS) with experience running a Helix streaming server, to purchase an Apple server in mid-2009 to set up an iTunesU online presence. I joined the University after they purchased the server.

As I explored functional requirements with MCE, we soon realized the formidable task of dealing with video as knowledge content, and how to engage with users, both academic and MCE staff to begin experimenting and using it. While university staff were keen to have something central for hosting videos, there was seemingly a wide array of requirements, perception and expectation which Trompenaars & Prud'homme (2004, pp. 13-45) regards as cultural conflicts. Complacency was easy to creep in when faced with the trauma of the likely change. Without a guiding coalition, the lack of a sustained effort in communicating the vision worsened the situation (Kotter, 2012, pp. 169-181, 145-150; Valikangas, 2010, p. 8). As van den Bosch & Duysters (2014, pp. 120-121) explained, a major effort was required for an enterprise innovation, ideally a dedicated team with primary stakeholders, delegated responsibility, clear mission and protocols, and the resources and infrastructure to act with significant urgency.

Faced with several major outreach initiatives, including numerous campus facilities upgrades and initial phase of the Malaysia campus, the university was not able to commit additional innovation effort to developing the VPS and so halted the project. Having lost commitment from the owner-sponsor from whom the work was first commissioned, ITS leadership decided there were enough stakeholders in UoR community to collaborate with and to use it that the work should continue. We formulated the vision and strategy, and assessed necessary technology components to build a solution, similar to Lafley's (2013, p. 14) "integrated cascade of choices" approach: discovering your winning aspiration, deciding where and how to win, what capabilities to use, and what management system to require where choices earlier cascade down to refine the process.

By the end of 2010, VPS went live. About a year later, MCE decided to transfer all existing video files over to VPS and started using it for their new videos. While MCE owns the design principles (e.g. choice of screen dimensions and encoding format) of video assets, the system is a technology-led innovation. It has required technologists to be entrepreneurs to align technological options with business requirements.

The tables below provide a snapshot of the number of video files processed by the system. (I left UoR in 2014. I am grateful to ITS for the updated stats.)

Table 1 Annual upload totals

Year	T&L	MCE	Total
2011	200	530 ¹	730
2012	260	170	430
2013	237	203	440
2014	248	156	404

Table 2 Top 3 uploads per year

Year	Months	Total
2011	Sep, Oct, Nov	530
2012	Mar, Sep, Nov	180
2013	Feb, Jan, Sep	203
2014	Mar, Feb, Jan	207

Table 3 Lowest upload per year

Year	Month	Total
2011	Apr / Jul	5 each
2012	Apr / May	20 each
2013	Apr / Nov	17 each
2014	Dec	2

Legend

T&L: teaching and learning

¹MCE transferred existing videos from a 3rd party supplier to the VPS in 2011.

3. BENEFITS

The VPS is the first enterprise-level end-to-end video upload, transcoding, storage and publishing workflow system in UoR. It is an important asset for the 17,000 students (13,000 UK and EU, 4000 non-EU, 9,300 undergraduates, 7,700 postgraduates) and 4,000 staff (2015 statistics, see <http://www.reading.ac.uk/about/about-facts.aspx>). Apart from teaching and learning purposes (missed lectures, revision, distance learning etc.), it provides a brand- and clutter-free solution for

marketing and recruitment purposes, compared to external social platforms (YouTube etc.). Its heightened significance was realized several times when confidential video communication to staff had to be disseminated by the University Executive Board quickly, the innovative open architecture made re-configuration easy. Although external social platforms had more features and global brand prominence, the knowledge community in UoR demonstrated sufficient passion for the vision to commit development and use. ITS collaborated with the stakeholders to produce an open collaborative architecture. This strengthened ownership of hardware, software and concept.

I implemented short-term win strategies (Kotter, 2012, pp. 121-135) to gain traction for uptake of the service and this benefited the community. MCE required transcoded videos to be stand-alone so that users had the options to play the video files directly, and content editors could embed files into web pages. MCE also stipulated h264 format in mp4 container to support progressive download. The open architecture supported these requirements. The benefits were immediately realized when more than 500 video files were re-transcoded for the VPS with no downtime and insignificant impact on ITS support. ITS decided to produce a high (640x360) and a low (320x180) density versions for each video, and from the 2013 upgrade, the option of webm format.

According to Kotter (2012, p. 126), a series of short-term wins the earlier in the innovation the greater the success rate of the innovation. I used this approach to gain stakeholder support, e.g. beginning in early prototypes, videos will play back on modern browsers on any devices. Another benefit is the community's shared terminology on video creation and publishing. It means removal of communication barrier which otherwise is a multitude of different words and phrases which could refer to the same standard or procedure, making community building extremely difficult. This early short-term win makes it very easy for any member of staff to communicate about video, in relation to teaching and learning or outreach campaigns, with other colleagues across the university.

Along with campus facilities upgrade, a number of departments began developing courses for distance learning (Law), professionals (Business), and materials for student recruitment (International Study). The Centre for Quality Support and Development (CQSD: for development and enhancement of teaching and learning) invested in several projects: the ASSET project "to encourage staff to experiment with the use of video media to provide feed-forward and feedback to students on their assignments", with funding from the Joint Information Systems Committee (<http://www.reading.ac.uk/videofeedback/>), progressing to DEVELOP (Developing and Enhancing Virtual learning environments and E-Learning Options, <http://blogs.reading.ac.uk/develop/>) integrating pedagogy with lessons learned from ASSET and then realizing the gains on the Blackboard learning management system.

The VPS was becoming a consistently visible, positive asset witnessed by many people (Kotter, 2012, p. 126). It benefited them by providing a single easy-to-use solution to publish videos that conform to best practice standards. To them, VPS was reliable, backed up by sufficient technical support. Several departments (Education, Theatre etc.) built on the above realized benefits to implement alternative e-learning materials (e.g. Flipped Classroom), and student-generated content for assessment.

With video becoming increasingly central in UoR, MCE and CQSD independently increased engagement activities (e.g. video shooting and production best practices) with their respective communities. Both were virtually walking in one pace with their realization that a change effort was being realized which in turn would benefit their work (recognising change effort, Kotter, 2012, p. 126). Very soon, both communities merged in a series of joint workshops and seminars, leading to creation of the Digital Development Forum central resource, which then formed several specialized interest groups (social media, video production etc.). As Trompenaars & Prud'homme (2004, p. 145) explained: "...on the one hand a corporate culture needs to fit the company's business strategy and business environment, so that corporate culture and value proposition are aligned, while on the other hand corporate cultures need to be adaptable to a changing environment... The challenge is to develop a corporate change that can recognize change in the environment, and which has the versatility to implement new ways of working and new value propositions while retaining the core."

The above benefits show that deliberate plans for short-term wins at the early phase of creating VPS led to long-term organizational-wide transformation (Clark, 1998, p. 4). Retrospectively, it's true that organizational culture change as precursor to innovation would have little progress without a

visionary champion to lead the innovation, but the champion would require a collection of deliverable promises - short-term wins leading to long-term gains - to secure organizational support.

4. Efficiency and productivity gains

VPS shows very high efficiency and productivity gain. Customers use a web site to upload their video file for transcoding to afore-mentioned acceptable standards. A few minutes later, they receive an email containing instruction for embedding their transcoded video in the Blackboard learning management system and the ActivEdition content management system. As VPS is fully automated, support personnel rarely get involved in day-to-day operation.

This is a huge gain since it presents a single, predictable and easy-to-use solution that is internally owned, against other solutions not fully in user's control in terms of operation, specific format or branding (e.g. YouTube), not built with resilience or incapable to scale (e.g. a department solution, postgraduate experiments).

The percentage of files that fails to complete transcoding is less than 5%. This is often due to unusual encoding used in the uploaded video, or the video is more than 90 minutes duration, causing transcoding errors. Upload failure rate is much higher, estimated at 20%, the single factor being the upload file is near to or over 2GB in size. I upgraded Episode in February 2014 and changed the host from the Mac to a Windows server. There have been no incidents or problems with VPS for over a year. This is proof of VPS' high efficiency and productivity gain, and contributes to improving staff efficiency and productivity.

VPS does not provide tools on video creation or live streaming. It's impossible to support an ever-changing video recording market, even high resolution webcams could generate unusual encoding formats. This ensured that project had a clear and narrow focus that would still have a very wide user base.

Technically, we gain efficiency in system components. By using open source (or public domain) software, we choose what parts of each component to use. Figure 1 shows several independent low-resource servers. Dropbox2, available at <https://turin.nss.udel.edu/wiki/dropbox/>, is free and customizable. With the exception of a Windows server on Dell hardware to support Episode, and JW Player, the others run Ubuntu operating system and Apache web server. ITS expertise evidenced in the hardware, system and communication methodology ensured high efficiency in this architecture.

Figure 1 VPS components

Component	Purpose
Upload webserver	To support upload, and workflow routine
Server with Dropbox2	To run modified Dropbox2 script, read and send emails
Storage server	To save uploaded and transcoded files
Transcoding server	To run Telestream Episode (licensed)
Delivery server	To disseminate files, and JW Player (licensed)

Figure 2 provides a representation of the system. It is clear that we could harness the high efficiency and productivity gained elsewhere in UoR along with the cost savings and knowledge transfer, e.g. the university standard PC configuration with its own expert team, and the use of NetApp which is already widely used in ITS with international large user base for peer support.

Figure 2 VPS overview

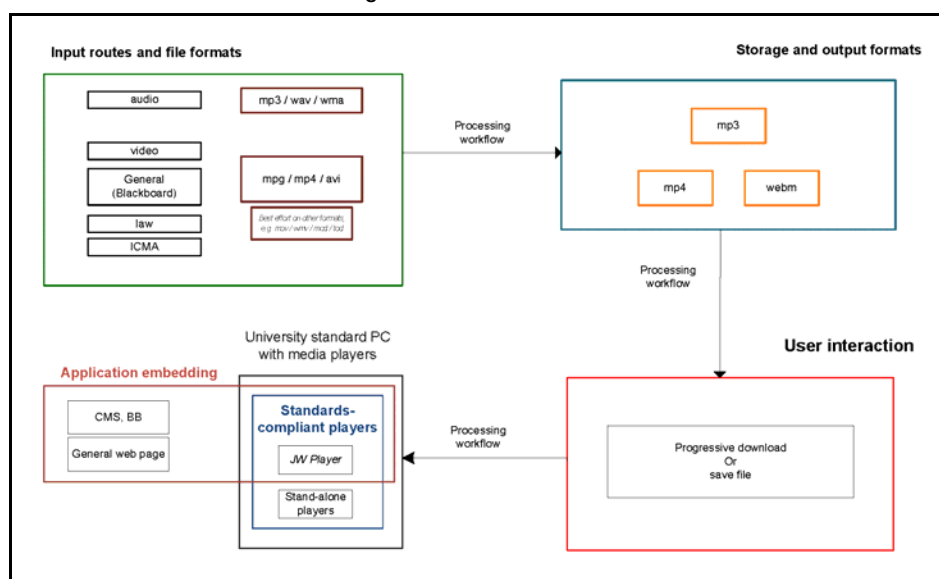


Figure 2 notes:

1. VPS also transcodes audio file to mp3
2. 'video' and 'General' in "Input routes" are teaching & learning and MCE videos respectively

As project manager, I gain further efficiency working closely with colleagues in ITS' Project Management Office. This ensures that the project has sufficient resource (time, experimental hardware and software, collaboration etc.) to commit each project stage to targets. It will be able to satisfy business requirements but also maintain a variable set of portfolios. The core technology being able to scale is a major benefit (Dees, 2001, pp. 188-192; Kearns, 2000, p. 154). It scales and adapts to meet a range of business expectations, e.g., integrating Business School's post-processing of scheduled lecture capture files.

5. Innovation

ITS took a pro-active approach, similar to Lafley's (2013, p. 14) "integrated cascade of choices", to lead this innovation to completion. Such an approach could impact at a scale too much to handle because innovation could cause unacceptable level of disruption to the organization (Meyer, 2014, pp. 9, 13). However, I have also taken a strategic approach to align with UoR's vision, in particular the potential gain that MCE and CQSD customer bases knew they could have a 'usable' system. Defining what different people mean by 'usable' is a formidable task. ASSET and DEVELOP had already created significant momentum along with a group of developers and users available for knowledge exchange, development and testing. This constituted the 'push' factor where they want to build on their lessons learnt to develop further.

The 'pull' factor came from the several departments developing courses that will use many videos as their primary media for teaching and learning. They need a system not only to handle a much larger scale than ASSET or DEVELOP, but also a much refined business requirement that undergraduates and professionals undertaking certification courses must be able to access the videos anytime anywhere. Meyer's (2014) Innovative Optimizer type fits this description where innovation output is roughly balanced on the radical-incremental scale.

The four principles in the strategy are:

1. Identify, engage with and manage potential stakeholder groups using project and service management best practices
2. Core system supports open framework, thereby supporting different types of users and different purposes

3. Ease of use for customers, supported by user guide and user community
4. Technical documentation to support training and knowledge transfer for administrators and support staff

To accomplish the above, I learnt that social engineering and entrepreneurship skills were useful to establish collaborative links and create a community of like-minded people to contribute ideas to the design of the technology and eventual use. I showed Dees' (2001) characteristics of social entrepreneurs in creating a core community and distributing responsibility. I was a 'dreamer' who drew up many detailed plans, pictures and drawings to engage with stakeholders. I used my leadership skill to create a 'crisis' to focus resources (Trompenaars & Prud'homme, 2004, p. 196) - the crisis being that we had to seize the opportunity now for the innovation before potential users became too much locked in to multiple other solutions which were less than ideal.

I recognized the leadership 'phases' associated with organizational lifecycles (Koplyay, Chillingworth, & Mitchell, 2013): beginning with a broad focus to engage stakeholders with an idealized future, innovation moved from large technical gains to incremental refinement. Using my leadership skill, I managed the gradual integration of the innovative product and services into ITS service catalogue. ITS provided the resources for me to "build authority through empowerment, to stimulate teamwork through individual incentives, to show courage through taking calculated risks, and to become consistent through learning from exceptional situations" (Trompenaars & Prud'homme, 2004, p. 56). My innovation exemplifies the Excellence model (Hudson, 2009, p. 192) where a result-focussed approach is backed up by a set of enablers on skills, knowledge and transfer, and policy and strategy. The loop completes with performance reviews leading to further learning and innovation.

I used SSADM (Structured Systems Analysis and Design Method) at the initial phase of the project to determine MCE's perception of current provision of video resources and intended future ideals envisioned in iTunesU. This drew out impact of implementation of their strategy which demanded staff resources throughout the project and lifetime of the product, at an unsustainable level for reasons already mentioned. The use of 'physical' and 'logical' diagrams ensured this process was as objective as possible. The key with this approach was to engage with stakeholder's perception of their intended product as fully as possible, providing room to formulate functional requirements.

In the numerous sessions of workshops I had with MCE, we discussed technology and procedure with respect to strategy and current organizational orientation towards the innovation and impending culture change. Brown (2014, pp. 212-214) stressed that organizational culture change is key factor for introducing innovative products and services, without which new policies and procedures, and new systems are unlikely to sustain for long and the innovation will fail. Taking risks might be seen as gambling with resources and opportunities. Dees (2001, pp. 125-160, 188-192) argued for enterprising skills to build and push organizational capability. Over time, through numerous consultations, I established there were enough substantive factors for innovation but I needed to closely monitor and deal with risks. With numerous campus upgrade and extension projects going on, the organization has demonstrated its strong resilience. An enterprise resilience, according to Valikangas (2010, p. 37), is not about refusal to change, but the capability to strengthen its core values through innovation and organizational transformation. When I completed the VPS innovation, I reached the point of organizational culture change that the iTunesU project had aspired for.

Taking an entrepreneurial approach with the stakeholders who were passionate for technological and cultural transformation was relatively easy. I organized numerous workshops and meetings for knowledge exchange and drawing up ideas to encourage change of organizational parameters (e.g. allow all staff to publish videos with no quality check) for short-term wins. I worked closely with systems colleagues to learn about and experimented with suitable technologies. I used Agile methodologies to maximize gain in technology-business alignment. I included a range of stakeholders at different stages of development, supported by the Excellence framework (Hudson, 2009, p. 192). This ensured that I had scope to manage technical and business priorities and risks in each workshop, avoiding a linear "develop - test - deliver" approach. Utilizing the benefits that came with high performance teams as I found in the stakeholders, I was confident that they would commit reasonable time to the project to explore outputs from different combinations of technologies to determine best options.

6. Imagination

I conceived VPS development in four “win formulae” communicate the strategy to stakeholders and users.

6.1. Win by vision

Championing a single-platform solution in a largely heterogeneous organization has its risk that it could be seen as a top-down implementation with little regard to requirements. This is even more so with a technology-led innovation since there is a tendency that too much priority is given to innovating technology constraining business practices to fit in. However, the strategy was successful having gained major support and commitment from stakeholders, with whom I then developed communication strategy to convince end users. A winning corporate culture needs to be “open for change and for diverse views ... to pursue paradoxical criteria simultaneously and reconcile them.” (Trompenaars & Prud'homme, 2004, pp. 23-24) It was a successful vision with endorsement from senior management.

Using project management best practice and entrepreneurial methods, the innovation gained further capabilities: that it will be clear, predictable and easy to use. Here, ‘clear’ means it does exactly what it claims to do and nothing else. In other words, no strings attached, available to any member of staff.

The innovation wins by having a strong cost leadership (Lafley, 2013, p. 82) where infrastructural expenses is very low (around £5,000), no cost at point of use, and stakeholders activities enhanced a forward-looking and dynamic organizational culture. It also wins by differentiation to support alternative configurations, e.g. support upload of video files larger than 2GB, and integration with Business school’s lecture capture architecture.

6.2. Win by being open

Forming an open community to identify requirements, steer development and undertake improvement was a winning formula because it encourages ideas and distributes responsibility. It further gives the project a greater sense of legitimacy and purpose when we began receiving positive feedback from senior management and wider community including external users. Hudson (2009, p. 173) explains that such a strategy increases the organization’s competitive edge because it builds on skills and abilities already present in the organization, and the internal stakeholders who are also developers and users are the best people to ensure the service fits the organization’s mission.

I acquainted with people from other institutions in conferences and workshops related to best practices in institutional video solutions. The open nature of such networking brought about a strong sense of community for support, ideas, learning and friendship. In particular it gave me richer and wider scope of user stories of innovation. This strengthened our mission that, given UoR context and available resources, the innovation is achievable.

By adopting a widely-accepted mp4/h264 format, the videos can be played back on the widest set of computers and devices. Another aspect of the winning formula is the additional support we provide to end users to manually transcode video files for them when resources allow. I have taken opportunity to engage with new collaborations and integration ventures to promote open-ness, e.g. alternative input process for videos for distance-learning Law students.

6.3. Win by being adaptable

When MCE withdrew from the project, ITS was able to consolidate resources and adapt to the situation. It tasked me to develop vision and lead the project so we could adapt to a more flexible set of stakeholders.

VPS architecture is very adaptable since the components (see Figure 1) are independent of each other. I have avoided a single point of failure scenario. When Episode software was upgraded which included a change from Mac to Windows server, I did not need to amend the architecture, including the period of testing with the operation of two transcoding servers.

Another winning formula is that transcoded video file formats (file types) can be amended in real-time with insignificant impact to the workflow. Episode on Windows was much more reliable in dealing with file format change than the older version we had for the Mac server. Further, the rest of the architecture, e.g. workflow routine, sending instruction email, required minor change to deal with changed file types. Producing both high and low resolution versions for each video ensured that there was room to adapt to low bandwidth connections so that users could still access the materials.

The architecture is adaptable in economies of scale in that Episode will handle a long queue of files for transcoding without causing runtime errors. The workflow script, however, is currently not saleable until a major modification to the code to allow for multiple instances of workflow supporting multiple extractions of uploaded video to the storage server. The architecture is also adaptable in each component's input and end points, which enabled integration with Business School's workflow.

6.4. Win by knowledge

The project has a winning formula by knowledge in the sense that we built on the latest stable file encoding types and architecture. We keep up with industrial best practice in server configuration, security, and browser integration and implement them where possible.

The project wins by knowledge in its critical analysis of existing business and technological shortfall. For an innovation to be successful, it is critical to understand the current situation, e.g., UoR culture, constraints and strengths. Having evaluated this knowledge with senior managers, I was in a much clearer and decisive position to design the innovation. I led the project to integrate business requirements and environmental awareness, and technological insights.

The link between organizational learning and accountability in innovation is noted by Hudson (2009, p. 192). Grouping stakeholders together enhanced knowledge and communication to set up VPS. I had some of the most talented and committed UoR colleagues in the stakeholder group. The group dominated the change agenda. Dees (2001, pp. 63-102) reported that mobilizing resources at critical phases of the innovation increased success rate of the work. In our case, the size of this community reinforced the project's legitimacy, accountability and commitment to its continual success.

7. Collaboration

The project began as a commission from MCE to ITS to install iTunesU to provide a workflow that supported video upload, transcoding, quality management, editing and publishing. As explained above, the lack of clear vision, strategy and commitment hampered progress. When MCE halted the project, the lack of closure and lessons learned was indicative of some turmoil within the organization. A project without owner, executive, sponsor or senior user, ITS senior managers decided that the knowledge and resources I had built up was sufficient for the project to continue with a different set of stakeholders, since the afore-mentioned ASSET, DEVELOP and other communities already had successful outcome and with whom we could collaborate for an enterprise solution. We reconfigured the project with an ITS Assistant Director as sponsor, while senior users was MCE as they were the design authority.

I established contacts with CQSD to discuss how we could collaborate on developing VPS. Their energetic engagement proved very useful. Two representatives - a lecturer who was also software developer, a learning enhancement officer who was also application developer - were pivotal in project lifecycle and service improvement. We collaborated on details of the working of each component (Figure 1) and their pros and cons. We reviewed benchmarking data within VPS and between alternative possible solutions for a thorough performance improvement profiling (Hudson, 2009, pp. 211-212, and Excellence model, p. 192), with respect to academic users where a simple, straight-forward, clutter-free, reliable operation will significantly increase uptake.

I re-established contacts with MCE to reinforce their role as senior user and resumed discussion about design specification, as well as gaining access to a wider set of stakeholders so that we had a richer set of user stories and requirements. While I preferred MCE being the sponsor, I gained insufficient support for this end. To contrast with another project taking place about this period, CQSD became sponsor for the Blackboard system: this was a better arrangement for the organization and ITS in particular, achieving a clear division of roles and responsibility to manage Blackboard.

Collaboration with MCE was useful to review quality management and user engagement requirements. We decided that user education is paramount to ease entry into video creation and editing, along with suitable documentation on how to use VPS. This effort contributed to the creation of series of events under the Digital Development Forum initiatives including the later formation of special interest groups. There was an uneasy balance between what different stakeholders viewed as 'simple and easy to use' even within the MCE community. Some preferred instructions and options available on the upload page; while others prefer an interactive submission process. These concerns remained unresolved.

This stalemate echoes Lafley (Lafley, 2013) who says many organizations that failed in innovation was because their leadership did not translate vision and mission into actions. Recognizing potential repeat of the iTunesU stalemate, I proposed a modified version of the CQSD workflow for MCE. Following testing, they transferred the hundreds of existing videos from a Flash server hosting provider to VPS. Further collaboration with MCE continued to prepare suitable documentation and events to publicize VPS and encourage uptake. To this day, the users from the MCE community who upload videos tend to be the 5-6 individuals in the MCE office. This is largely because they are sponsors of outreach and enhancement campaigns where video is part of several activities. They carry out quality approval and then publish the video to VPS.

Collaboration with systems colleagues was fundamental to progress in VPS. My role was to align technical solutions to business requirements. Fundamental design principles included (1) scalable: available to all staff, multiple instances of upload, transcoding and delivery, (2) open: architecture was adaptable and easily reconfigurable for different purposes, and (3) part of service catalogue: the technology was within skill sets of ITS colleagues, has sufficient community support and/or maintenance contract, and to merge into ITS suite of applications for service management. There was an uneasy balance between best practice principles, and the attitudes, knowledge and actions of people who uploaded video. Systems colleagues kept up-to-date with and contributed to latest developments in server and media technologies including specific strengths and pitfalls which could reduce servers and streaming (progressive downloading) performance. In contrast, end users tended to use available technology and may not take steps to protect their files. Over time, we learnt to concentrate on technologies that had the widest scope, and contributed to user education via MCE and CQSD.

8. Technological integration

At system level: on a Linux (Ubuntu) server, I have written Perl scripts to integrate with MS Exchange to extract video files and save them to a NetApp storage server. Sendmail on the Linux server sends instruction email to customer and notification email to ITS.

At application level, Systems colleagues provided a modified Dropbox2 implementation for me to further adapt to varying workflow requirements, e.g. CQSD and MCE. I configured Episode for Mac, and later Episode for Windows, to integrate with NetApp storage in order to ingest and transcode video files. Systems configured an Apache web servers (on Linux) to provide the mechanism for file upload into Dropbox2.

At delivery level, I installed JW Player to support Flash and webm embedding on web pages, and provided embedded code for CQSD and MCE who then developed their respective solution: a web tag for the ActivEdition system and a widget for the Blackboard system.

At architectural level, the above servers and their corresponding communication paths are supported and protected by Active Directory enterprise authentication and appropriate security protocols.

This technical design is an open framework to support modified integrations, e.g. file copying to NetApp instead of upload, and integration with faculty lecture capture server post-processing

9. Transferability

The technology is easily replicable since it upholds open standards and industry best practice. Linux and MS Windows servers configurations and workflow scripts are easily replicated since they are standard methodologies and have large user communities for help and support. The components (e.g. Dropbox2, Episode) can be replaced or modified given VPS' open architecture.

Project, service and technical documentations are available for anyone to consider transferring or replicating such architecture in another institution. Since each organization differs greatly from others in their operation, structure and culture, the concept (architecture) and related documentation are merely starting point. It will require an enterprising innovative effort to implement VPS in another institution, or to design anew using VPS as a reference.

10. Conclusion

VPS being a successful innovation is largely due to the outlook of the organization. According to Kearns (2000) and Dees (2001), similar organizations that are successful in their innovations have moved away from a “mandate” outlook (e.g. a center to disseminate knowledge) to one that is energized by mission, e.g. to maintain leadership in joint ventures with commercial organizations. To do that, organizations need to have sufficient resilience and capabilities and a creative culture. Within this environment, I have found that I needed to journey into working patterns that might be regarded as unorthodox, and management approach that is more results- rather than objective-driven.

I often recall how technology-led innovations in the 1990s, e.g. email, were successful because consumers had no choice. After the myriad choices e.g. in content and learning management systems of the 2000s, the current decade sees triumph of several suppliers in each space taking majority market share. Even so, consumers are regularly dissatisfied by the university system, whether having gone through an acceptance process or not, or more satisfied by external systems. There appears to be more to be said about consumer culture than technology. VPS is conceived with a mix of 1990s top-down one-system-for-all approach (the way videos are integrated in learning and content systems effectively states the acceptable policy of use), and integration of user stories and requirements. This is perhaps fundamental reason why the technology remains efficient, stable, and open since the service was launched, and consumers continue using it to the point where the service becomes part of the essence of the university.

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12. AUTHORS BIOGRAPHIES



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Educational background BA (Hon) (University of Leicester), BSc (Anglia Ruskin University), MA (The City University, London), MEd (The Open University, UK), MBA (The Open University, UK), PhD (University of Sheffield)

Scientific degrees BSc Computer Science (1998), MBA Technology Management (2012), PhD Ethnomusicology (2005)

Work Experience IT roles as analyst, and in leadership and management in UK Universities: Cambridge, Open, Reading and University College London. Undergraduate and postgraduate teaching experience in computing / technology and music in University of East London and The Open University.

Current job Technology Manager, Information Systems Division, University College London

Three previous jobs (1) Research E-learning Developer, University of East London, May 2013 - August 2013, (2) Web Technologies Officer, University of Reading, UK Aug 2009 - Mar 2014, (3) Research Computing Officer, The Open University, UK, Oct 2000 - Jul 2009

Awards (1) Finalist The EUNIS Dørup E-learning Award 2010, (2) Staff Merit Award, University of Reading, (3) Staff Merit Award, The Open University, (4) Staff Development Award, The Open University, (5) Foundation Fellowship, The Open University, (6) Foundation Award, Anglia Ruskin University



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Educational background BA (Hon) MA(Cantab) (University of Cambridge), MSc (University of Surrey), MSc(RMET) (The Open University, UK), PhD (The Open University, UK)

Scientific degrees BA (Hon) MA(Cantab) (University of Cambridge), MSc (University of Surrey), MSc(RMET) (The Open University, UK), PhD (The Open University, UK)

Work Experience Education Technologist/Researcher, Institute of Educational Technology, The Open University; School e-Learning Advisor, University of Reading; Researcher, Serious Educational Games, University of East London; Human Computer Interaction Module Instructor, The Open University

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Three previous jobs (1) Associate Lecturer (Human Computer Interaction), The Open University, UK (2) School e-Learning Co-ordinator/Lecturer, University of Reading, UK (3) Doctoral Researcher, Institute of Educational Technology, The Open University, UK,

Awards (1) Foreign and Commonwealth Office Award (2) Royal Academy of Engineering Award (3) The Institution of Civil Engineers QUEST Award (4) The Chartered Institute of Building International Innovation and Research Award (5) Phi Delta Kappa Outstanding Doctoral Dissertation Award (6) The Open University Practice-based Professional Learning, Teaching and Learning Support Excellence Award (7) EUNIS Dørup e-Learning Award finalist (8) WISE/UKRC Woman of Outstanding Achievement Tomorrow's Leader Award