Zen and the art of learning object repositories: an alternative methodology for creating successful learning object repositories.

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ABSTRACT. The vast majority of repositories, whether for research or learning objects, are suffering from a common failing, namely the lack of objects being placed in the repository. This paper seeks to identify the major differences in the way that a project like this would be created in a commercial, as opposed to an academic, environment. The central theme is that repositories projects have a greater success rate if, during the initial stages, the planning issues are identified from a 'problem based' rather than a 'solution based' perspective. The effectiveness of this approach is witnessed by those repository projects which are successful, including a number created by the University of Derby's Innovation 4 Learning Unit.

Introduction.

The University of Derby describes itself as 'Not a research university but a teaching university.' In comparison with most universities this is true. Whilst little of its turnover derives from research, Derby has a roll of around 26,000 students and, interestingly, approximately 40% of these are over the age of 35. As a result, Derby is at the forefront of developing technology supported learning systems to support their very large cohort of work-based or distance learners. Innovation 4 Learning is a unit created in 2004 to commercialise the results of the University's work in technology supported learning and make these systems available to both the education and commercial sectors on a 'for profit' basis.

I have, without question, the best job description in the world. I get a warm feeling every time I overhear myself being introduced; 'Have you met the Head of Innovation for Learning from the University of Derby?' However, this warm feeling is quickly replaced with the need to explain that, as someone who left school at 17 with some very average A-levels, joined the Army, then had a career in the IT and Telecomms industries, I am almost always the least academically qualified person present. Having spent 30 years in industry, a number of them as managing director of one company or another, I was recruited by the University on the basis of my business, not academic, pedigree.

Innovation 4 Learning works in four main areas of technology supported learning:

Firstly in the area of learning delivery systems. These we take to include virtual learning environments (where we recently created, for the University for Industry, the second largest after the Open University) and learning object repositories.

Secondly we have a team who create learning objects. These are predominantly e-learning objects but also include games-based (or serious gaming) objects created within the University's Derby Games Studio.

Thirdly we have a team creating computer aided assessment products and content. This is building on TRIADS, a system that has been developed within the University over a ten year period and is used to run tens of thousands of assessments each year.

Lastly we have a willingness to be involved with any other technology supported learning project which we believe that we can make a positive contribution to, and that will further our ideas and understanding of technology supported learning.

When still quite new in post, I was invited to attend a JISC funded event[1] where a number of repository projects reported on their progress. Of the nine project reports, seven had startling similarity. These projects had all appeared to take the 'Field of Dreams' approach of 'Build it and they will come.' It quickly became evident that, in fact 'They' had not come. This was witnessed by embarrassed admissions that after one, two, or in one case three years, the repositories where still effectively empty. The other two projects had indeed managed to create repositories which did have content, but the reason for this content was not, I felt, fully explored. Whilst all of these projects were technically sound, the reasons for the absence or otherwise of content were largely ignored with the focus being put on adding technical functionality – the approach of 'Build a bit more and make it better and then they will come!' - rather than addressing, what I felt, was the fundamental issue.
This experience led me to examine the projects in progress at Derby and to examine the key fundamental differences between those project which had attained a degree of success and those which had not yet, and then to compare this with the methodology and approach that I would expect in a commercial context to projects of this type.

This is not intended to be an analysis of the efficacy of repositories or the pedagogy of learning objects, nor is seeking to promote the only approach – or even the most successful approach; rather it is suggesting an approach that demonstrably works.

One of the joys of my role is that I get to work with some of the leading experts in their field, and it is only correct that I acknowledge the advice and guidance I have received from three of these, Professor David Young (Professor of Work Based Learning,) Professor Don Mackenzie (Professor of Computer Aided Assessment) and Dr. Sarah Malone.

Background.
In their recent paper 'Genonimo's Cadillac' [1], John Casey, Jackie Proven and David Dripps highlight 'the importance of taking the local context and culture into account when developing and implementing technological solutions in complex social systems like education. The failure of the government-backed UK e-U virtual university being a case in point. Many of the failures in software development and engineering are down to this basic error – i.e. of not understanding the needs and situation of the users.'

It is also well known that lack of user research is one of the largest factors in the failure of projects within the software industry. A report published by the Standish group in 1994, ('The Chaos Report',) compared software engineering to construction and civil engineering made the following criticism:

"When a bridge falls down, it is investigated and a report is written on the cause of the failure. This is not so in the computer industry where failures are covered up, ignored, and/or rationalized. As a result, we keep making the same mistakes over and over again."

Whilst this criticism is to some extent redundant these days, the IT industry (and it is not alone in this, just look at the shopping channels on television) does still produce a very large number of solutions desperately looking for a problem. The single factor that identifies the better and more successful developments is where there is a clear understanding of the problem before the solution is designed. This is the fundamental criticism of the majority of 'build it and they will come' repositories.

The approach which the better developments take is

Understand problem ⇨Understand user requirement ⇨Understand value of problem ⇨Design solution to problem.

Define the problem.
The definition of the problem, at its most fundamental, is a series of phrases or sentences which establish the scope of the problem or the ambition. These phrases should always contain one the following words: Save, Protect, Reduce, Increase, or Gain. The inclusion of these words is an indication of the validity of the definition; the absence of all of these words from the phrase or sentence should call into question the validity of that statement. Hence the problem to be addressed by a learning object repository might (in part at least) be summed up as:

'We need to:
- Reduce the institution's costs by the elimination of duplication of already existing learning objects
- Save money by reducing the time taken to introduce new learning modules
- Increase the consistency of our learning so as to increase our academic results

By creating a repository of re-usable learning objects'

Having created our definition we can now start to cost the problem.

1. JISC DRaW Repositories Event on 19th & 20th May 2008 at Diglis Hotel, Worcester

Costing the problem.
Once we have a full definition of our problem we are able to start calculating the cost (value) of the problem. This is a mathematical exercise and in most cases, given that the difference between the cost of the problem and the cost of the solution is sufficiently large, absolute accuracy is not necessary and a 'reasonable' degree of accuracy is generally acceptable.

The calculation of the cost of duplicated object is largely an exercise of the 'If it takes two Vice-Chancellors three days to fill a bath, how long does it take five Assistant Deans?' variety. The formula is broadly:

Number of objects duplicated each year X average creation time X average cost of creator's time

In order to cost certain elements of the problem certain standard metrics can be applied, for example, in the case of academic results, the University's financial experts will be able to offer a basic formula for how student achievement affects university turnover.

In his recent key note address to the UNICO conference Professor Eric Thomas, Vice-Chancellor of Bristol University[2], quoted government research which calculated that the effect of a university on the regional economy equates to approximately twice the university's turnover, and when the contribution of the alumni was calculated the benefit to the local economy was between six and eight times the institution's turnover. This is worth bearing in mind if external funding may be sought, particularly from the Regional Development Agency.

The combination of these costs allows us to establish an overall cost (value) associated with the problem.

Emotional cost.
It is also important that note be taken of, and where possible a cost attributed to, the 'emotional' as opposed the 'tangible' cost of the problem.

This is best explained as follows:

My neighbour and I both have a problem with mice in our houses. After consultation we find that we both suffer £100 worth of annual costs attributable to damage by these rodents. Having decided to pool our efforts in researching solutions to this problem I wandered down to the local village shop which, I found, sell old fashioned 'break neck' mouse traps for £1.99 each. My neighbour discovered the latest anti-mouse technology, the ACME Mouse Disposal System.

The ACME Mouse Disposal System, retail price £1,000, uses the power from a small nuclear reactor to tele-port errant rodents to a pre-determined location in any direction and up to a distance of 500 meters from their point of origin.

My cost/benefit analysis is easy:

1. Problem costs £100. Break neck mouse trap costs £1.99. annual saving of £98.01 – Yes, this is the solution for me.

2. Problem cost £100. ACME HMDS costs £1,000. Annual saving -£900 – No, no benefit to me.

My neighbour, on the other hand, has the added issue of a family of card carrying, vegetarian, members of the small rodent preservation society – each of whom is, unfortunately, terrified of mice.

His cost/ benefit analysis was a little more complicated:

1. Problem costs £100. Break neck mouse trap costs £1.99. Cost of killing small rodents is infinite grief. Annual saving irrelevant!

2. Problem costs £100. Cost of doing nothing £0.00. Cost of family coming face to face with small furry rodent is infinite grief. Annual saving is irrelevant.

3. Problem cost £100. Cost of ACME HMDS £1,000. Benefit of family NOT coming face-to-face with small furry rodent is peace and tranquility. Annual saving is too large to calculate given the alternatives.

This demonstrates, I hope, the importance of not ignoring – and where possible assigning a value to - identifiable emotional or intangible costs/benefits.

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2. Professor Eric Thomas, Vice-Chancellor, Bristol University, Higher Education's role in the Bristol City region and the South West, UNICO CONFERENCE, Mercure Holland House Hotel & Spa Bristol, 4-6 June 2008. Additionally the effect of the UK university sector on the UK economy was calculated to equate to approx. 8% of GDP

Barriers to success.
To quote again from the excellent paper 'Genonimo's Cadillac' (Casey, Proven and Dripps) [1]:

'The lesson we refer to in the title of this paper and epitomised in the phrase "Geronimo's Cadillac" – is that of trying to use technology in an area that is not yet ready for it, as this extract from a training document produced by Digitalinsite® explains:

"Geronimo, last free leader of the Apache nation agreed to a peace treaty and was sent to live on a reservation. As a peace offering the US government made a gift to Geronimo of what was at that time one of the most advanced items of technology they had – a new Cadillac motor car. The trouble was that on the reservation there was no one who could drive, no mechanics, no oil, no petrol and no roads. Geronimo was forced to pose in it for photographs but after this the car was used as a chicken coop."
www.digitalinsite.co.uk'

I believe that the greater issue here is not, as the quoted paper promotes, that the technology is not ready, but rather that the initial concept stage of the project has not been adequately completed. It would be patently absurd to invest in the design, manufacture and marketing of an internal combustion engine that used a fuel not commonly available, one would expect that one of the key actions identified in the project plan would be the creation of an appropriate fuel distribution network before, or at least simultaneous to, the launch of the engine. However, it does appear that the vast majority of less than successful repository projects have rather taken this approach.

Given that technology is not likely to be an issue provided that the chosen solution is actually fit for purpose, the obvious threat to any repository project is academics not submitting content. In the majority of projects where this has happened the reaction tends to be to add or simplify the technology using an approach of 'Okay, that didn't work but if we build it better/simpler then this time they WILL come!' Frankly this is unlikely.

When I asked academics what prevents them from submitting learning objects to a learning object repository I received four common answers:

- Quality - A wish to avoid the embarrassment of colleagues realizing just how poor my current objects are
- Recognition - Why should I? I don't get any benefit or recognition if my good objects are used by a colleague
- Provenance – The possibility/probability that content may not be correctly referenced and the desire to avoid claims of plagiarism
- Intellectual Property – who owns it, the academic or the institution?

All of these issues are, of course, surmountable albeit at a possible cost. The cost of the solution should include sufficient funding to finance:

- The improvement, where a better object does not currently exist, of poor quality objects
- The creation of recognition systems whereby academics, together with schools and faculties, get peer and financial recognition for objects which are used by colleagues. This could include a pay-per-click model where the academic and school receive a financial benefit or an OPD (on going professional development) model where academic status is improved on the basis of, amongst other things, the quality, number and use of objects via the repository
- Funding to acquire rights, improve citation or create new content which avoids any possible doubt as to provenance.
- The nominal purchase of IP rights or, for example payment of pay-per-click benefits to mitigate any perceived IP issues

Given that the single most important element of any repository project is academic engagement, it never fails to amaze me how low a priority this is given in most projects.

Cost of the Solution.
This is the piece of the process that is commonly done well. The only comment I will make on this that the costs of mitigating the barriers to success should be treated as part of the costs of the solution and that, given the year-on-year saving of the 'cost of the problem' provision should be made for ongoing mitigation funding.

Cost/Benefit analysis.
As outlined in the hypothetical case of mouse damage above, once the costs of the problem and the costs of the solution (including the costs of overcoming the barriers to entry) have been calculated it is possible to create a cost benefit analysis which allows, amongst other things, the success of the project to be objectively monitored.

There is often a fear that the ability to track the success of a project via the performance against a cost/benefit analysis could be a risk. It should be understood that this is only one of the monitoring mechanisms and one that should at all times be understood in a wider context. With rare exceptions as in the case of pure research, we are all spending taxpayers' money and should, as we are also taxpayers, be prepared to stand up and justify the purpose and benefit of that which we spend.

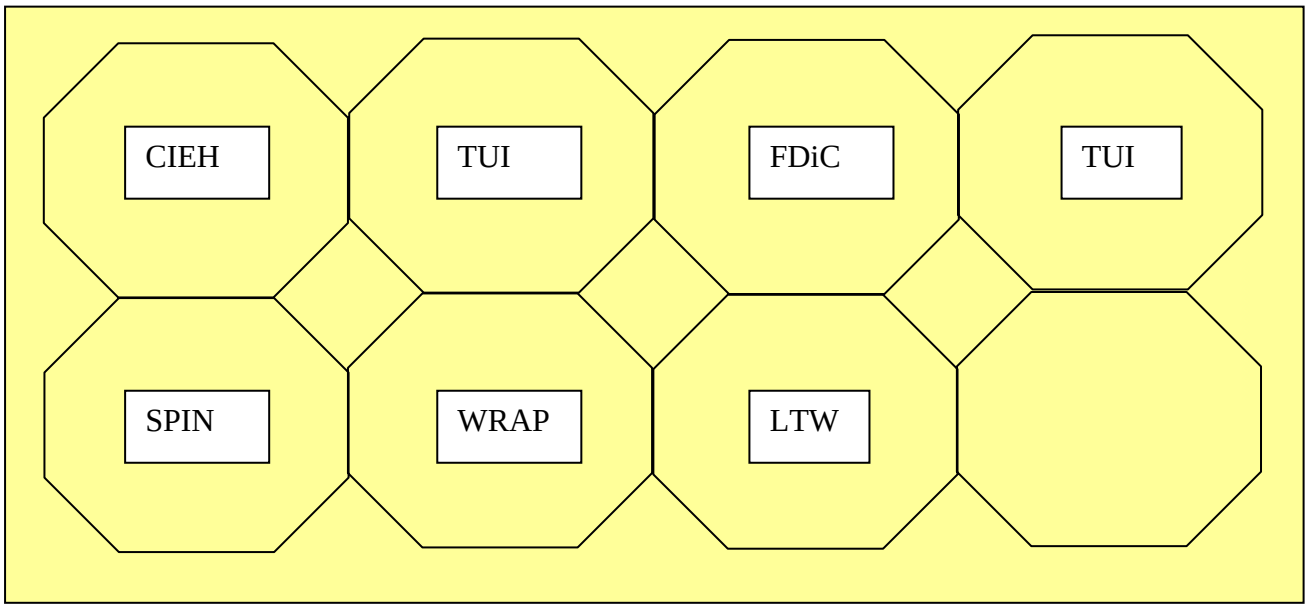
Does this lead to a 'blame culture'? I acknowledge that in badly managed organization this can be the case but would strongly argue that the benefits to projects of ongoing monitoring leading to re-evaluation and re-planning make projects infinitely more likely to be successful in the long term than those that are unmonitored. The former Chancellor of the Exchequer Dennis Healey is credited with creating the truism which is 'Healey's law of holes – When in one stop digging!' However, in order to stop digging we first need to know that we are indeed in a hole, and be able to tell the difference between a true hole and a slightly lower position than another observer. Only with analysis of valid and finite comparative data can we make a valid decision.

Ownership.
The final issue which appears to have a substantial influence on the success or otherwise of a learning object repository project is ownership of the problem of creating objects.

In a lot of cases the ownership of this issue is held at a high level with either ownership of the entire problem being held by a small group, or with the problem being held at faculty level. Analysis of the repositories within the University of Derby suggests that this approach is less likely to be successful than an approach where the responsibility is broken up and devolved downwards such that there are multiple owners of corresponding smaller problems. It does appear obvious that the responsibility of acquiring ten learning objects is much easier to discharge than the responsibility for acquiring five hundred or a thousand objects. What this approach creates is a macro-repository made up of a number of micro-repositories.

One of the key benefits of this approach, particularly when taken in conjunction with funding available for mitigating the key barrier to success is the creation of a positive competitive ethos. It is common to hear one school or faculty commenting 'Have you heard how much JISC funding the X faculty got last year? We didn't get anything like that. We really must make a greater effort this year!' and this natural competitiveness, when academic credibility as well as financial reward come into play, can be a major factor in the success of a repository project. This ultimately leads to vibrant micro-repositories assimilating to become a highly effective macro-repository.

Innovation 4 Learning's own internal repository works in exactly this manner, being made up of a number of micro-repositories. Each of the representative micro-repositories contains e-learning objects created for an individual project.



The object economy.
I do not intend to enter the discussions regarding open or closed repositories, however, I have no doubt, and to an extent Innovation 4 Learning have demonstrated, that it is possible to create an object based economy. At it's most basic level this leads schools or subject areas within the same institution to share and trade objects, but this could and should create a far wider level of inter-institutional trading. Innovation 4 Learning has lines of business today based upon the selling of learning objects, most notably PLATO – Plagiarism Teaching Online which has been purchased by a number of institutions around the world.

Given the predicted challenges that universities will face over the coming years and the academics who have told me that they feel a stronger tie to their subject nationally than to their institutions, the benefits of cost reduction, flexibility and mutually profitable co-operation that repositories bring should be self evident. Despite cries that 'The Repository is Dead!' I think we should be looking forward to dancing on the grave of ill-preparation and woolly thinking and be ready to celebrate the births of a host of vibrant and successful repository projects that will produce the benefits that we are all keen to see.

As I said at the beginning, I am not promulgating this as the only way to approach repository projects, or even as necessarily the best approach. I am however commending this as an approach which has proved extremely effective for Innovation 4 Learning at the University of Derby.

References:
1. Casey J. Proven J. Dripps D. Geronimo's Cadillac: Lessons for Learning Object Repositories, CFSIC'06, 2006