



Economic Sustainability Reference Model (ESRM)

Summary

For the 4C Focus Group Session at iPRES, Lisbon

September 6th 2013

The following text is a summed up version of the ESRM report. In preparation for the 4C focus group session on September 6th 2013 please take a look at the text having these questions in mind:

1. From your perspective, if you were going to design a sustainability strategy for digital assets, where would be the most logical place to start?
2. Think about an influential model, framework, template, workflow etc. Why do you think it managed to get traction amongst practitioners? (OAIS is the obvious example, but there are others, e.g. DCC Lifecycle Model, Micro-services, DRAMBORA, PREMIS, METS)
3. Could the ESRM be presented in a way that is more useful?



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1 Introduction

The purpose of a reference model is to help cut through complexity and highlight key concepts, relationships, and decision points in a complex problem space. It should also help the user of the reference model to benchmark and compare their own local models with an exemplar which has broad acceptance from a community that is relevant to the activity in question. It is clear that the economics of sustaining digital assets (by means of digital curation) is exactly the kind of complex area that might benefit from such a reference model.

The ESRM builds on existing work (<http://unsustainableideas.wordpress.com/economic-sustainability-ref-model-page/>) that was conceived and developed by Brian Lavoie (OCLC) and Chris Rusbridge (Chris Rusbridge Consulting) following their central involvement with the influential Blue Ribbon Task Force for Sustainable Digital Preservation and Access (BRTF). Lavoie and Rusbridge's work, co-sponsored by JISC and OCLC, was a first attempt at translating the concepts, findings, and recommendations of the BRTF report into a *reference model for economically sustainable digital curation*. It defines the notion of a sustainability strategy; highlights the key concepts planners must take into account when designing that strategy; and enumerates the kinds of economic risks that the sustainability strategy should defend against. The goal was to build a tool to aid planners in building clear, persuasive arguments to help unlock the resources needed to support sustainable digital curation activities.

The ESRM is best understood as a strategic tool for planning and discussion aimed at executive and managerial rather than operational level staff. Its purpose is to provide a foundation for progress in the development of successful sustainability strategies for digital curation. It does this by organizing the problem space; providing a common reference point of concepts and vocabulary; and introducing a layer of abstraction that hides the complexities and idiosyncrasies of individual implementations and contexts, while at the same time embodying sufficient detail to support substantive discussions of shared issues.

The ESRM organizes its discussion of economically sustainable digital curation around the concept of a sustainability strategy which is composed of several key components:

- Economic lifecycle: the economic “context” in which curation occurs
- Sustainability conditions: the conditions that must be met to achieve sustainability
- Key entities: the curation environment, including digital assets; the curation process; and stakeholders that must make decisions to ensure the sustainability conditions are met
- Economic uncertainties: forms of uncertainty that present challenges in regard to achieving the sustainability conditions

Some high level assertions can also be extracted from the model which may provide a good starting point for general discussion (and which relate to the key entities section).

- The properties of digital objects must be realistically examined and understood before they can be defined as assets;



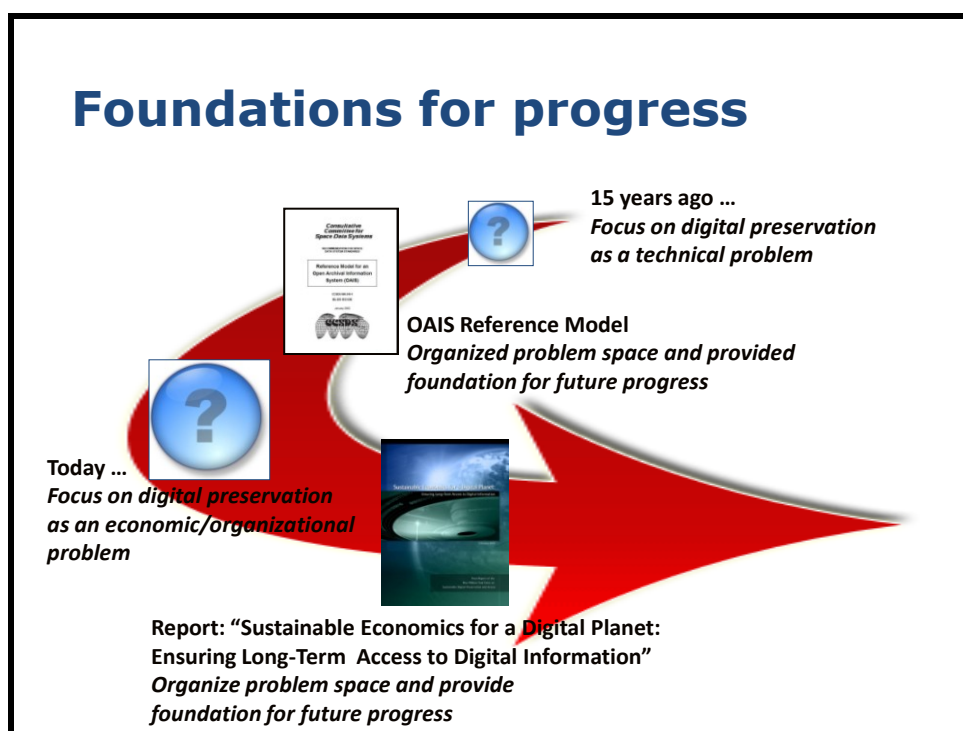
- Sustaining digital assets (the process) is complicated but not impossible to organise and understand if you take the view that it is about ensuring there is sufficient 'return on investment';
- The assets and the processes are not themselves intrinsically important: the crucial issue is whether the value of the assets is sufficiently understood by the relevant stakeholders

The ESRM report, the basis for this condensed document, revises and updates Lavoie and Rusbridge's draft model, and situates it as a key component of the 4C Project. The ESRM is one of the outputs of the Enhancement working group (WP4) and aligns well with its remit to think more widely and holistically about the topic of sustainability. However, development of a reference model is an incremental process that by its nature needs input and endorsement from a broad community before it can lay claim to being a valid model. Therefore, it is expected that the ESRM presented in this document will continue to evolve through an ongoing process of community consultation and feedback.

2 Purpose of the ESRM

The purpose of the ESRM is to provide a foundation for progress in the development of successful sustainability strategies for digital curation. The well-known OAIS reference model catalyzed progress in the development of technical solutions for digital repositories by organizing the problem space, providing a common reference point of concepts and vocabulary, and introducing a layer of abstraction that hid the complexities and idiosyncrasies of individual implementations and contexts, while at the same time embodying sufficient detail to support substantive discussions of shared issues. In the same way, the ESRM proposes to catalyze progress in creating sustainable solutions in the domain of digital curation, by performing these same functions in regard to economic issues related to the long-term curation of digital assets.

Figure 1 – Foundations for Progress



An example serves to illustrate these points. It is not unusual to encounter confusion in discussions about economically sustainable digital curation in regard to the scope of the topic. Some participants equate a sustainability strategy with a cost model. Accurate cost projections based on a good cost model are indeed a key aspect of any sustainability plan, but they are far from the whole story. As the BRTF report powerfully argues, achieving sustainability goes well beyond an understanding of how much it will cost to preserve a gigabyte of data for a given period of time. A reference model that defines the concept of sustainability, its components, and the relationships between these components, is a useful tool for promoting a shared and complete understanding of the problem space on the part of all participants in discussions that bring together stakeholders with disparate backgrounds and perspectives.

3 The Draft Framework

Economically sustainable digital curation is a complex topic even when discussed only in generalities. It becomes even more complex when applied to the particular circumstances of a specific digital curation activity. The ESRM helps planners navigate this difficult terrain by defining a general concept that represents the “target” planners need to aim for – *a sustainability strategy*. A sustainability strategy is the means by which a digital curation activity orchestrates the economic factors necessary to ensure that the activity has adequate resources to meet its long-term curation goals.

A sustainability strategy can be broken down into four primary components: 1) an economic lifecycle; 2) sustainability conditions; 3) key entities; and 4) economic uncertainties.

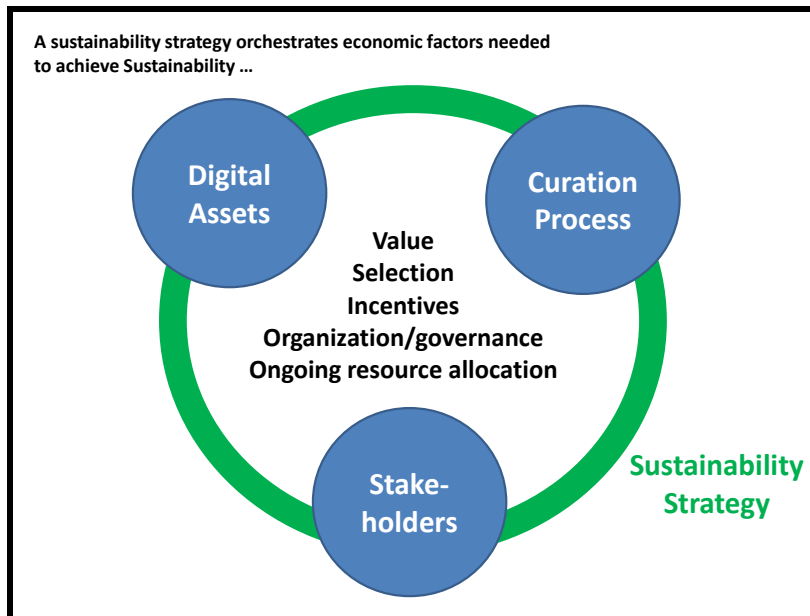
3.1 The Sustainability Strategy

A sustainability strategy orchestrates the economic factors necessary to ensure that a digital curation activity has adequate resources to meet its long-term goals. It is a plan that organizes the key entities associated with long-term sustainability – digital assets, the curation process, and stakeholders – in such a way that the curation activity becomes a *sustainable economic activity*. A sustainability strategy is enacted over the entire economic lifecycle of the digital assets, guiding the curation activity through the significant events that occur during this lifecycle. It is designed to address each of the five sustainability conditions enumerated in the BRTF final report. Finally, a sustainability strategy addresses significant economic uncertainties that may occur during the economic lifecycle by incorporating plans and contingencies to mitigate the effects of these uncertainties.

The essential components of a sustainability strategy may be understood as:

- **Economic lifecycle:** the *dynamic pattern*, or sequence of events, against which the sustainability strategy operates;
- **Sustainability conditions:** the *conditions* the sustainability strategy must address in order to achieve sustainability;
- **Key entities:** the key elements of the economic *environment* – digital assets, the curation process, and stakeholders – whose properties and relationships shape the circumstances in which the sustainability strategy operates;
- **Economic uncertainties:** *frictions and obstacles* that may potentially act to impede the ability of a repository to achieve economic sustainability; the sustainability strategy must anticipate these uncertainties and if necessary, mitigate them.

Figure 2 – Sustainability Strategy Components



Takeaways:

- A sustainability strategy orchestrates economic factors to ensure a curation activity has sufficient resources to meet its long-term goals over the entire economic lifecycle.
- Achieving sustainability means meeting the BRTF’s five sustainability conditions.
- To design a successful sustainability strategy, planners must understand the properties of the key entities; identify significant economic uncertainties associated with the properties; and identify appropriate remedies to address the uncertainties.
- No sustainability strategy is perfect; it can only maximize the prospects of achieving sustainability, not guarantee it.
- A sustainability strategy must evolve as conditions evolve.

3.1.1 The Economic Lifecycle

Takeaways:

- Economic decision-making for digital curation is a dynamic, sequential process unfolding over time, rather than a once-and-for-all event.
- Curation decisions, especially as they bear on sustainability, must be regularly revisited, re-evaluated, and if necessary, revised.
- An economic lifecycle model highlights the major economic decision-points which typically occur over the “life” of digital assets, from creation to possible disposal.
- The general pattern of economic decision-making for digital curation includes two endpoints – when digital assets are ingested, and when they are removed from archival retention – with a cyclical period in between where the digital assets are made available on an ongoing basis, until an interruption to the cycle occurs.
- Disruptions to the regular cycle of ongoing availability can be anticipated or unanticipated.

3.1.2 Sustainability Conditions

These are:

- Value
- Selection
- Incentives
- Resources
- Organisation

Takeaways:

- A clear understanding of what sustainability means in a digital curation context is essential in designing a sustainability strategy.
- The BRTF final report identifies five sustainability conditions.
- Value: identification of a clear stakeholder interest in the long-term curation of a particular set of digital assets.
- Selection: Resources are limited; we must prioritize and make choices. Where possible, digital assets should be selected for curation that promise the greatest value through use over time. Selection decisions should be re-visited and re-evaluated regularly.
- Incentives: Sustainable digital curation requires stakeholders who are willing to sponsor or carry out the curation process, based on robust motivations or incentives to curate.
- Resources: Curation activities require sufficient resources to achieve long-term goals. Mechanisms need to be established to transfer funding and other resources from those who benefit from and are willing to pay for digital curation, to those who are willing to curate. Once obtained, curation resources should be used as efficiently as possible.
- Organization/governance: An organizational form for curation should be chosen that is appropriate to the conditions under which it is expected to operate. A governance mechanism is also needed to articulate curation goals, formulate a strategy to achieve them, assign curation responsibilities, and evaluate outcomes.

3.1.3 Key entities

- Digital assets are
 - *Digital assets are durable yet depreciable*
 - *Digital assets can be curated by one, but used by many*

Takeaways:

- Digital assets are digital objects that are *judged to have a value that will persist over some period of time.*
- Digital assets share several core properties that impact sustainability planning.
- Because digital assets are durable but depreciable, planners must consider the “total cost of ownership” associated with maintaining them in a usable condition for an extended period of time. Rather than *one-time chunks of funding, sustainable curation activities require flows of funding.*

- A digital asset can be curated by one stakeholder, but used by many users simultaneously. Because of this, the incentive for any user to contribute resources to curation is weak. This *free-rider problem* can make it difficult to collect sufficient resources among beneficiaries to sustain curation. One solution is to exclude beneficiaries from access to the digital assets if they do not contribute toward curation.

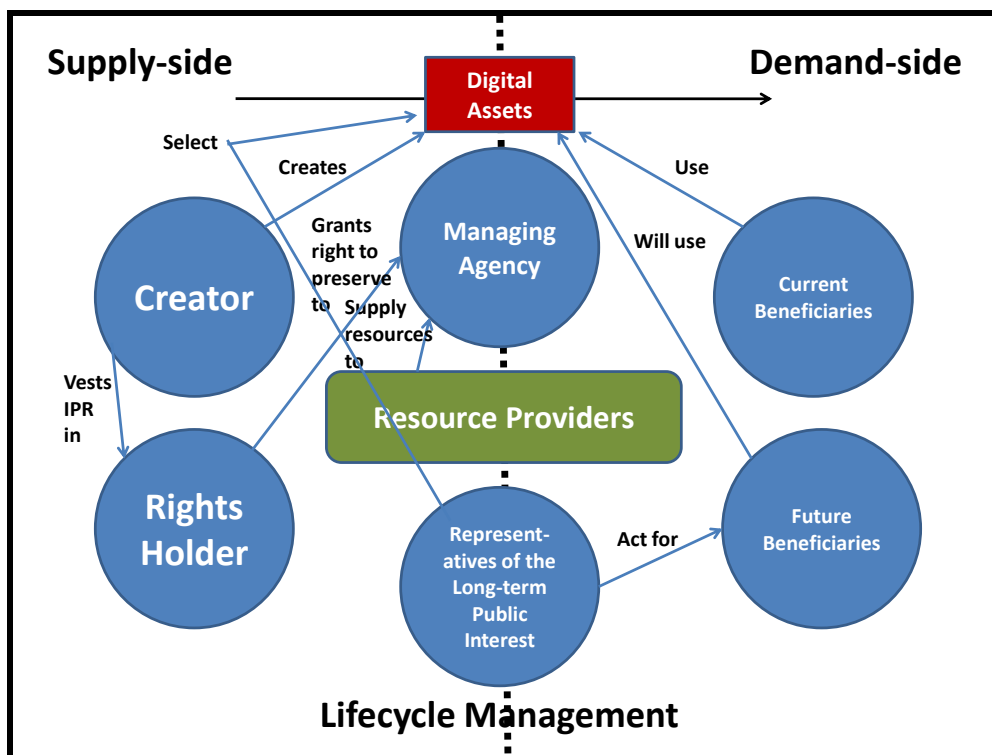
3.1.4 Curation Process

Takeaways:

- The *curation process* is the set of activities involved in maintaining digital assets in a usable form for an extended period of time.
- The value of the curation process derives from its ability to deliver the value of the digital asset. In economic terms the demand for the curation process is a derived demand – in this case, derived from the demand for curated digital assets.
- Curation decision-making is path-dependent. Decisions made at one stage of the economic lifecycle shape the choices available to decision-makers at later stages.

3.1.5 Stakeholders and the Stakeholder Ecosystem

Figure 3 - Stakeholder Relationships: Example



Takeaways:

- The wide range of stakeholder interests associated with many digital curation activities, and the relationships between them, heavily impacts the prospects for achieving sustainability, as well as the shape of the sustainability strategy best suited for the circumstances.
- A stakeholder eco-system designates the key stakeholder roles in long-term digital curation, and articulates important relationships between them as they relate to sustainability.
- Stakeholders fall into three general categories: **Supply-side** (Creators; Rights Holders); **Demand-side** (Current Beneficiaries; Future Beneficiaries); **Lifecycle management** (Managing Agencies; Representatives of the Long-Term Public Interest; Resource Providers). A sustainability strategy that neglects to account for the interests and participation of any of the stakeholder categories is likely to founder at some point in the economic lifecycle.
- The stakeholder ecosystem can be understood as three layers of abstraction that, taken together, illustrate the way stakeholders are organized within a particular digital curation context, and how that organization might harbor economic uncertainties impacting sustainability. The first layer is the **types of stakeholder roles associated with most digital curation activities**; the second layer describes the **relationships existing between stakeholder roles in a given digital curation context**; the third layer describes the distribution of stakeholder roles across distinct individuals or organizations.
- It is important to recognize the distinction between stakeholders as distinct entities and stakeholder roles. A single organization (or individual) can fulfil multiple stakeholder roles simultaneously.
- The distribution of curation roles across the network of stakeholders is *critical for identifying economic uncertainties* inherent in a particular configuration of the stakeholder ecosystem.

3.1.6 Economic Uncertainties

Uncertainties could affect many different aspects of a digital curation activity. Assuming some sort of service for the management or curation of digital assets over time, uncertainties can affect:

- The creation of the service
- The continuation of the service
- The termination of the service
- The succession or transformation from one incarnation of the service to another, whether in succession or in parallel, e.g. through the handoff process (including legal and other agreements), through migration of the assets, identifiers etc, through revised technology for the underlying service, or new owners or policies
- The quality of the service
- All or some digital assets in the service.

This list is not exhaustive!

Broadly speaking, there are four ways to respond to a perceived uncertainty:

- *Avoidance*: stop the activity with the uncertainty.
- *Mitigation*: lower probability and/or impact of uncertain event.

- *Transfer*: pass uncertainty to another party (e.g., insurance).
- *Acceptance*: recognize the uncertainty but choose to “ignore” it.

Takeaways:

- Myriad economic uncertainties exist throughout the economic lifecycle. While it is impossible to eliminate these uncertainties, anticipating as many of them as possible, and incorporating appropriate plans and contingencies to mitigate their impact, is an essential part of any sustainability strategy.
- There are four general ways to respond to a perceived uncertainty: *avoidance* (stop the activity with the uncertainty); *mitigation* (lower probability of uncertainty occurring, or reduce its impact if it does occur); *transfer* (pass uncertainty to another party (e.g., insurance)); *acceptance* (recognize the uncertainty but choose to “ignore” it).
- Risk-averse organizations may be unwilling to expose themselves to any significant risks. But a significant trade-off usually resides in avoidance strategies, in the form of a reduction in capacity and/or benefits, in return for avoiding uncertainty.
- Mitigation reduces the likelihood of an uncertain event occurring, reduces the effect or impact if it does occur, or both. Mitigation does not fully eliminate the probability or impact of the uncertainty, but reduces them sufficiently to make incurring the uncertainty acceptable to repository planners.
- Transfer can be effected through something like an insurance policy, or by transferring a risky activity to another organization. Other organizations may be willing to accept such transfers because the risky activity is central to their perceived mission.
- Acceptance involves recognizing that an uncertainty exists, but taking no particular action to avoid, mitigate, or transfer it. The advantage of acceptance is that it incurs no extra costs involved in avoiding, mitigating or transferring uncertainty; the disadvantage is that if the uncertainty manifests itself, the repository is fully exposed to its impact.
- Avoidance, mitigation, and transfer have costs, which need to be weighed against their perceived benefits. Best practices are needed as to which economic uncertainties should be addressed in a sustainability strategy, and which approach is the preferred method for addressing each of them.

4 The ESRM Role in the 4C Project

The 4C project was conceived to look across a complex area of work, assess the different perspectives and approaches, and then to synthesise them and represent them more meaningfully to new and existing stakeholders. This aligns well both with the purpose of an EC coordination action and with the needs of the broad community who have witnessed many attempts over twenty or so years to either describe, model or quantify how much digital curation costs; or how organisations might best be configured or strategically persuaded to invest in their digital assets. Lists of the various relevant initiatives (quoting sources as far back as 1980) have been compiled¹ and there has been commentary urging the community to stop duplicating effort and exploit existing work more effectively.²

So the 4C project is working in the context of a community that is beginning to voice dissatisfaction (or perhaps impatience) with attempts to tackle the cost of curation. But what is also apparent from these bibliographies and commentaries is that although the topic is clearly understood to be multi-faceted and complex, it would appear (based on the non-hierarchical and uncategorised way that the lists are compiled and the references made) that it is convenient and logical for those wishing to understand the connections and boundaries of the topic to categorise it all as broadly to do with taking an economic perspective on curation.

The following is a non-exhaustive and conceptually overlapping list of the types of issues that are addressed by the literature³:

- Contingent valuation
- Ecosystem valuation
- Intangible assets
- Investments
- Information markets
- Sustainability
- Incentives
- Cost modelling
- Lifecycle modelling
- Loss costing
- Business modelling

¹ Open Planets Foundation, Digital Preservation and Data Curation Costing and Cost Modelling, <http://wiki.opf-labs.org/display/CDP/Home> (accessed 21/07/2013)

and Library of Congress, A Digital Asset Sustainability and Preservation Cost Bibliography, <http://blogs.loc.gov/digitalpreservation/2012/06/a-digital-asset-sustainability-and-preservation-cost-bibliography/> (accessed 21/07/2013)

² Wheatley, P. (2012), Digital Preservation Cost Modelling: Where did it all go wrong?, <http://www.openplanetsfoundation.org/blogs/2012-06-29-digital-preservation-cost-modelling-where-did-it-all-go-wrong> (accessed 21/07/2013)

³ This list is taken from a presentation given at PASIG, Dublin 2011: Grindley, N. (2011), Costs Versus Benefits, <http://www.slideshare.net/neilgrindley/digital-preservation-costs-versus-benepasig-dublin-oct-2012-dp-costs-final2> (accessed 21/07/2013)



- Cost-driven design
- Cost/benefit analysis
- Net financial benefit
- Net economic benefit
- Net social benefit
- Shadow pricing

Given the expectation emerging from the community that any new work on the costs of curation should be cognisant of the much more extensive work referred to above, the Economic Sustainability Reference Model is a highly useful method of concisely capturing a whole range of concepts and approaches that have a bearing on the economics of curation and provides the 4C project with a framework and a jumping off point for the work outlined in Work Package 4 (Enhancement).

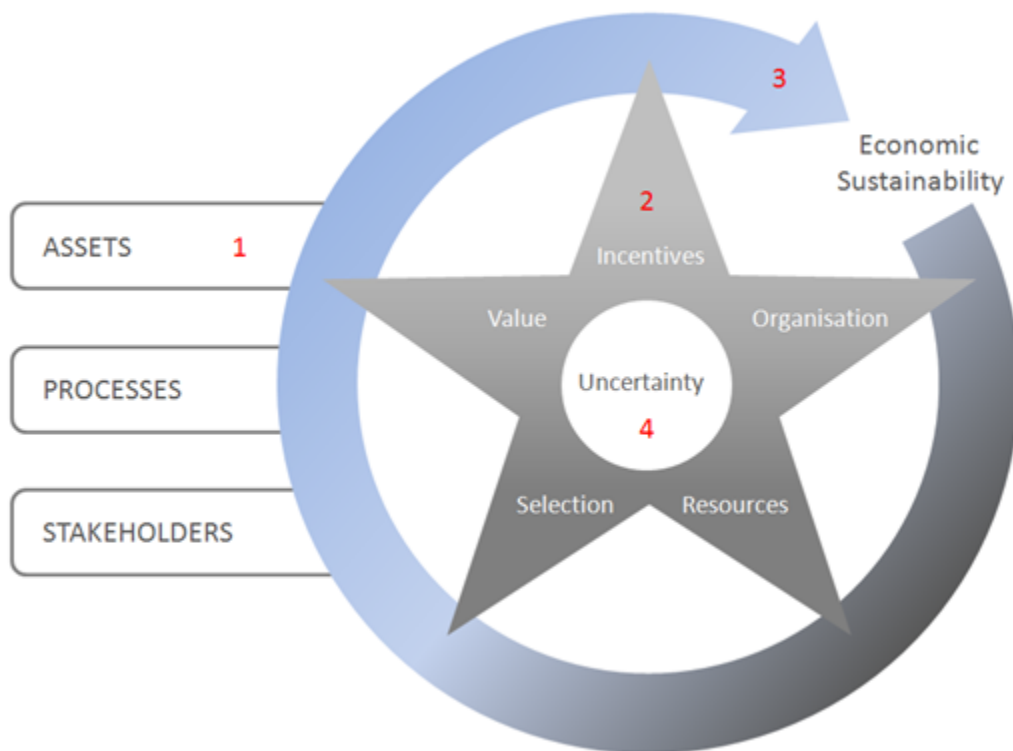
5 Implementation and Tools

The ESRM in its current iteration sets out a number of concepts, many of which originate from the work done by the Blue Ribbon Task Force on Sustainable Digital Preservation and Access. The model is designed to be read as a standalone resource (perhaps with some accompanying introductory text) and in future will almost certainly be presented discreetly from the rest of the contents of this report and the work of the 4C project. However, the intention of the 4C project is to attempt to see how the ESRM work can be applied and implemented so the following section is an examination of *one possible implementation* of the ESRM according to the requirements and purposes of the 4C Project. As will be made clear in the next section (Next Steps) there is an expectation that community input will continue to shape and hone the model but there is, as yet, no certainty that either the graphical representations will become intrinsic or attached components of the model as it is taken forward for validation (or critique) by the broader community.

5.1 The 4C Candidate ESRM Graphic

A concise candidate representation of the ESRM is shown below and it has two primary purposes. Firstly, it is emblematic of the full description of the model (which is mainly a text-based resource) and is designed to be a concise visual reference (a logo) for the model and useable at a range of different scales, with or without the text annotations (see figure 4).

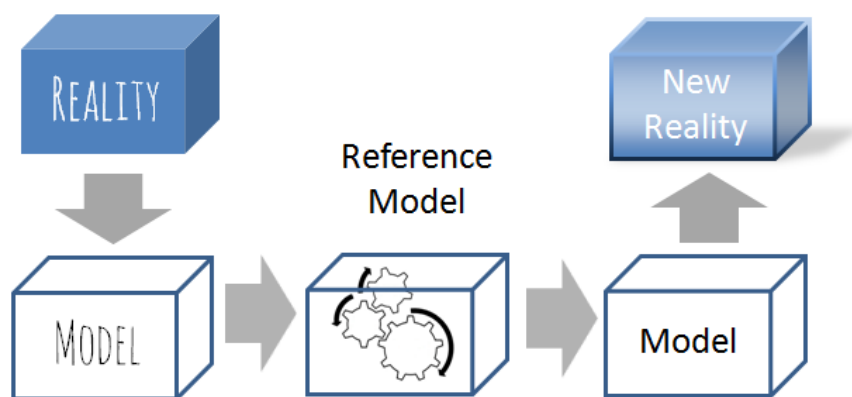
Figure 4 – The layout of the components of the ESRM



5.2 Reference Model as Change Tool

Early discussions within the 4C project questioned the purpose of a reference model and what extra meaning it conveys over and above the simple term ‘model’. One possible definition of the term ‘model’ is that it is *a simplified version of the real world*.* Taking this definition, the purpose of a reference model is to allow a local model to be compared with a community validated and generic yet comprehensively thought-through elaboration of the concept. This may provoke ideas for changing the local model to address shortcomings or imprecision, which in turn should suggest ways of changing the reality that the model represents.

Figure 5 – Reference model as change tool



* Included in the 4C Project Glossary and paraphrased from <http://www.businessdictionary.com/definition/model.html>. This definition of ‘model’ and slight linguistic variants of it are widely referred to in relation to economic modelling.

6 Next steps

Should the model not find traction with the community it may still have a role to play as a 4C engagement mechanism. However, it is hoped that there will be an audience and a demand for it and 4C has designed some opportunities into the project workplan to facilitate further discussion.

- The ESRM as a community developed resource
- The ESRM as an engagement mechanism

Anyone who is interested in talking to the 4C project about the ESRM or any aspect of the work on the costs and economics of digital curation should contact the project via the website (<http://www.4Cproject.eu>) or via email at info@4cproject.eu.