



EGI-Engage

Concept of EGI Marketplace

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Abstract

This document provides an analysis for the EGI marketplace and a proposal for conceptual framework, business processes, business models, and recommendations.



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TERMINOLOGY

A complete project glossary is provided at the following page: <http://www.egi.eu/about/glossary/>

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1 Introduction

To be competitive, researchers need access to high end research resources (e.g. instrumentation, software, knowledge, computing, data), but no single research group or institution can house all the needed research resources to perform the types of cutting edge interdisciplinary research expected, nor would this be cost effective. In addition to this European research faces the challenge that policies and infrastructure are fragmented as a result of member state borders.¹ Research resource sharing is already done with large research resources such as CERN with the LHC (Large Hadron Collider)² and large synchrotron facilities (e.g. Paul Scherrer Institute, German Electron Synchrotron), but also smaller instrument resources and services from core technology platforms (e.g. genomics, proteomics, microscopy, 3D printers) and local lab resources (e.g. two photon microscopes, clean rooms) are vital and should be shared. In order to overcome this it is proposed to make a marketplace for research resources, which is used by researchers independently of organizational boundaries and national borders. This also is aligned with the vision of the European Commission of creating a single digital market for Europe³ and can help increase the competitiveness of European research.

Providing researchers with world-class research resources (computing, software, data, instruments, etc.) and services (consulting, sample preparation, collaborations, etc.) is essential for helping researchers to be competitive. We think that this can be done using a marketplace concept, where free and paid resources can be listed and discovered. In addition, this marketplace can enhance visibility for resource and service providers, raising awareness of what they can provide as well as helping to promote cross-disciplinary research.

¹ European Commission, "European Charter for Access to Research Infrastructures," June, 2015, http://ec.europa.eu/research/infrastructures/pdf/2015_charterforaccessto-ris.pdf, accessed August 6, 2015.

² Wikipedia, "Large Hadron Collider," https://en.wikipedia.org/wiki/Large_Hadron_Collider, accessed August 2015.

³ European Commission, "Digital Single Market," <http://ec.europa.eu/priorities/digital-single-market/>, accessed August 2015.

2 Problem Statement and Goals

With the technologies (instrumentation, expertise, etc.) required to perform and support all aspects of research becoming increasingly sophisticated and subsequently more resource intensive, it becomes increasingly important to share resources. In addition, the trend is that research is increasingly interdisciplinary and interconnected and often spanning multiple research groups as well as institutions, further necessitating the need to share resources. These trends lead towards a more open science and research process involving the use of open data, open code, annotation, data-intensive science, open access, and new forms of collaboration. Therefore, the sharing of technical resources and expertise at the institutional as well as the international level is of strategic importance to all researchers. The primary impediment to this is the lack of effective tools to do so, which we attempt to address by the development of a marketplace as a service concept for research resources delivered as a Software as a Service (SaaS) solution to simplify and facilitate this.

The following potential benefits can be expected from developing a marketplace as a service:

- Ensure efficient resource usage at the institutional, national, and international level.
- Allow cost sharing with accounting, billing, and enabling of fair usage of resources.
- Facilitating resource discovery at the institutional and inter-institutional level.
- Allow researchers and institutions to focus on value creation as opposed to maintaining redundant resources.
- Researchers can discover expertise that can be tapped into based on usage of resources registered.
- Remove administrative burden from technology platforms allowing them to focus on technology delivery instead of administration.
- Increase competitiveness by providing a low cost of entry to expensive technologies for small academic institutions and businesses.
- Facilitate inter-disciplinary research by providing access to technologies typically considered outside of a particular field.
- Avoid re-developing the same solution (tool duplication).
- Collaborative improvement of services and resources.
- Possible reduction in costs of by facilitating complex application implementation and integration (e.g. issuing of persistent identifiers, providing links between resources and services).

3 Background

Most of the emphasis for resource sharing has been placed on the sharing of computational resources or large international research infrastructures (large telescopes, synchrotrons, etc.). However, there are many other technologies that are needed on a daily basis by the vast majority of researchers in the long tail of research to perform their work. It can be costly to acquire and run cutting edge instruments and technologies, which puts small labs and small research institutions at a disadvantage. Even large institutions do not have the resources to establish all technologies that their researchers may need, or at least not at the necessary quality level, so they also benefit from resource sharing. The availability of and access to competitive resources is also extremely beneficial to small and medium enterprises (SMEs) in order for them to be competitive. Through the solution proposed in this project, SMEs may save precious resources if they can have a platform to help them discover and provide access to technology they need for their products. In addition, resources are often duplicated unnecessarily because of lack of knowledge of existing resources nearby or lack of tools to effectively share existing resources that are often times underutilized. The operation of potentially redundant technologies impedes research and is a suboptimal use of the available research funding. Just as the social networking sites such as ResearchGate (currently 4 million active users) and Mendeley (about 3 million active users) enable scientists to share scientific output, from an information knowledge exchange perspective, however, there is no established common platform to allow for effective technical resource sharing today.

In the commercial segment things such as hotel booking, car sharing, public clouds, etc. have developed into multi-billion dollar businesses. However, there is still limited adoption of these tools in academia for resource sharing. In this activity we examine current requirements and activities, and try to develop a model how a marketplace can be put into place for research resources.

3.1 Cloud Enabling Research Resources

The term “cloud” is well known, but the meaning of cloud is often misunderstood. This misunderstanding is further entrenched by official definitions from agencies like National Institute of Standards and Technology (NIST)⁴, and is often thought of in the technological perspective. Cloud itself is just a business model enabled by technology, as well described in the book “Clouonomics”⁵. The model itself is based on the principle of outsourcing of commodity tasks to

⁴ Peter Mell, and Timothy Grace, “The NIST Definition of Cloud Computing,” NIST, September, 2011, <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>.

⁵ Joe Weinman, Clouonomics: The Business Value of Cloud Computing, (John Wiley & Sons, Inc., 2012)

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achieve economies of scale allowing the end user to focus on value creation.⁶ It is felt that by defining the appropriate business model we can cloud-enable research resources needed by researchers to deliver “Science as a Service”. In order to do this we must build upon the well-established Electronic Marketplace (EMP)⁷ models for the platform to succeed.

3.2 Electronic Marketplace Models

There are well-known reference models of EMP. Unfortunately, these are generally defined in terms of delivering only of cloud computing services. Instead this needs to be thought of in a broader context that allows for any type of resource to be “cloud-enabled” and provided via a marketplace. Cloud-enabled in this context means to make it possible to share any resource with anyone, which is already well established with commercial web sites (e.g. car share services, co-working spaces). In addition many of these EMP models rely on a notion of a Cloud Service Broker (CSB)⁸, which is an intermediary to help the end user identify and use cloud services. Though it can be seen that marketplace services such as www.ebay.com, www.bookatable.com, www.booking.com, etc. provide a platform for resource providers to deliver normal commodity services to consumers without the need for an intermediary, as the platform itself serves as the broker in allowing consumers to identify services of interest based on metrics (e.g. number of recent bookings, number of sales) and feedback from other users of the platform. The brokerage model with an intermediary has some inherent weaknesses (e.g. conflict of interest, leakage to direct sales, scaling). So adapting these well-known EMP models and examining cloud service providers delivering commodity services will help us define the EMP business model for a “Science as a Service” (SciAAS) platform.⁹

⁶ Bany Mohammed, et al., “Cloud Computing Value Chains: Understanding Business and Value Creation in the Cloud. Economic Models and Algorithms for Distributed Systems”, (Birkhäuser, Springer, Autonomic Systems book series, 2009)

⁷ Beat F. Schmid, and Markus A. Lindemann, “Elements of a Reference Model for Electronic Markets,” IEEE, January 17, 1998,
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.195.1349&rep=rep1&type=pdf>.

⁸ Smitha Sundareswaran, Anna C. Squicciarini, and Dan Lin, "A Brokerage-Based Approach for Cloud Service Selection," IEEE June 24, 2012.
<http://www.computer.org/csdl/proceedings/cloud/2012/4755/00/4755a558-abs.html>.

⁹ Renee DiResta, “Science as a service,” O’Reilly, January 30, 2013,
<http://radar.oreilly.com/2013/01/science-as-a-service.html>.

4 Methodology

The challenge to provide a marketplace for research resources is not just a technical challenge, it also requires understanding the needs of researchers and resource providers, as well as developing a business model to make it sustainable. In this activity we have performed a survey and several interviews to get the requirements from researchers and research resource providers. In addition we have developed service scenarios for resource usage and resource providers to develop detailed requirements. We have also examined other related research marketplaces to understand how our activity compares to them.

4.1 Requirement Analysis

One survey and several interviews were performed with sixteen large resource providers and research communities (EGI, Barcelona Supercomputing Center, SURFSara, EMBL-EBI, VENUS-C, France Grilles, DARIAH, STFC, MTA SZTAKI, Cyfronet, GRNET, CSC, Biomed Grid, Neugrid, iMarine, WeNMR). The survey feedback and interviews helped determine if there is interest in a marketplace solution from the perspective of researchers as around half of respondents represented user communities, and from the perspective of resource providers as around half the respondents represented resources providers. In addition the survey and interviews were used also to help determine the requirements for such a solution.

4.2 Service Scenarios

In the course of the EGI-Engage project different marketplace usage scenarios were developed based on the experience of EGI working with research resource users and providers. Different scenarios were done from the perspective of the end user, resource provider, and platform administrator. These usage scenarios were then used to elucidate needed features and formulate detailed requirements for the system.

4.3 Related Work

We have examined other electronic marketplaces targeted at the research sector or with the aim to facilitate innovation being done by FI-WARE, GEANT, UberCloud, Science Exchange, Internet2, and Helix Nebula. These activities are very diverse and can provide insight into this activity. It can be decided also to use one of these activities to provide the marketplace or to partner with them.

4.4 Operating Model

To develop an operating model we used a variety of business analysis methods. We used one of the most widely used tools for business model development, which is Business Model Canvas¹⁰. Using this tool we did a comparison to some other established business models. Then we analysed the outputs of this by performing a SWOT analysis. Then as an extension to using Business Model Canvas we did a Blue Ocean Strategy analysis to further develop the business model.

¹⁰ Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", John Wiley & Sons, Inc., 2010.

5 Requirements Analysis

5.1 Need for Marketplace for Researchers and Resource Providers

When asked about improving the discoverability of resources for researchers and if research resource providers would benefit from a marketplace for research resources the following totals we reached:

Do you know researchers, research projects, or research communities that would benefit from discovering research services/resources in a marketplace?	94%
Do you know researchers, research projects, or research communities that would benefit from providing services/resources in a marketplace?	81%

Need for a Research Discovery and Provisioning via a Marketplace Concept

Based on this result it can be seen there is strong feeling that researchers could benefit from facilitated resource discovery and research resource providers could benefit from providing services into a marketplace.

5.2 Form of the Marketplace

When asked in what form the marketplace could be provided in the following responses were given:

EGI marketplace	94%
Into a “open science commons” space	88%
Private marketplace (e.g. separate portal)	50%
Branded community marketplace	50%
Technology-specific marketplaces (e.g. Ansible Galaxy, Docker Hub Registry, etc.)	44%
Other	31%

Feedback on the Forms of Marketplaces of Interest

From this it can be seen that most respondents would be interested in advertising resources into an EGI marketplace and in an “open science commons” space. However, there is also significant interest in private and branded marketplaces. Ideally a marketplace solution should be able to accommodate these multiple cases with one solution by allowing publishing in multiple marketplaces at one time.

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5.3 Essential Features of a Marketplace

In order to determine the important or essential features of the marketplace the participants indicated which features of a marketplace would be essential/important and those that were not important. The responses are indicated here:

Rate the following functionalities:	ESSENTIAL/ IMPORTANT	NOT IMPORTANT
service description	100%	0%
direct link to the service	100%	0%
filter by...	87%	13%
status of the service: up & running, down, etc..	87%	13%
visibility/access rules by user, group, organization, department, community, project	75%	25%
categorization of EGI affiliation (e.g. integrated, endorsed, external)	56%	44%
user rating	50%	50%
visibility/access rules by VO	44%	56%
prices	37%	63%
negotiation phase	31%	69%
visitors of this service have also viewed	25%	75%

Rating of Importance of Features in a Research Marketplace

Based on a threshold of 50% we have assigned in order of priority:

1. service description
2. direct link to service
3. filter by
4. status of the service
5. visibility/access rules by user, group, organization, department, community, project
6. categorization of affiliation
7. user rating

These functionalities will then serve as the starting points of the proposed solution.

6 Service Scenarios

The scenarios of use that individual resource providers use to fund their activities are extremely diverse (pay for use, free to use, academic, commercial, co-financed, etc.). The solution developed will need to have the ability to allow for all the different usage models, and the resource provider will need to decide which tools to use based on how they finance the provisioning of their services. In addition many times resource providers use a mixture of scenarios to fund their activities.

The following marketplace user stories have been assembled by EGI based on the requirements from the e-Infrastructure space. These have been analysed and the detailed requirements summarized in Appendix I.

6.1.1 Service Marketplace User Story 1

- The service provider publishes a service
 - The service provider (SP) registers a new service in the service catalogue
 - The SP can assign a service level agreement (SLA) to the new service
 - The SP assigns a price to the new service (can be zero for free services or different prices for different user segments like SMEs, internal users, external academic users, etc.)
 - The SP can define a policy to access the service
 - The new service is available in the service catalogue
- The customer discovers the existing services
 - The customer accesses the service catalogue and gets the list of offered services
 - The customer can look for a service with specific characteristics/requirements (search engine)
 - The customer can read the details of a service: description, SLA with how to accept and penalties for underperformance, price, SPs list, creation date, last update, etc.

6.1.2 Service Marketplace User Story 2

- The customer directly selects and buys a service
 - The customer accesses the service catalogue and looks for a service
 - The customer chooses the service to buy
 - The customer may negotiate the SLA through a broker or accept a pre-defined SLA associated to the service
 - The customer buys the service
- The customer selects a service through a broker
 - The customer lists the requirements that should be satisfied by the service they are looking for

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- The broker identifies the best service according to the customer's requirements
- The broker offers the selected service to the customer
- The customer evaluates the offered service, may negotiate the SLA through a broker or accept the pre-defined SLA
- The customer buys the service

6.1.3 Service Marketplace User Story 3

- The customer reviews and rates a service and/or a SP
 - The customer selects a service from the list of bought services
 - The customer reviews and rates the service and/or the SP
- The customer wants to check the status of his orders
- The customer consults the consumption/usage
- The customer manages the service
- A SP manages the published services
 - A SP registers into the service catalogue
 - Hides previously published services / changes the conditions associated / highlights the services / announces a maintenance break

6.1.4 Service Marketplace User Story 4

- A SP checks the information associated to services
 - The SP controls the accounting information related to their services (usage, number of users, average consumption) and they can control either by service published or total

7 Related work

7.1 Examination of related work

Other marketplace activities in research were examined. This is not a comprehensive list, but hopefully representative. The examination of other business with a broader context was done within the business model development section.

7.1.1 FI-WARE Marketplace

The FI-WARE Marketplace is an innovative idea to bring a collection of tools that can be used by developers to establish marketplaces or deliver Software as a Service (SaaS) tools. It in itself is a marketplace of tools that can be used to develop complex software solutions.

7.1.2 GEANT Cloud Catalogue

The GEANT Cloud Catalogue is a list of cloud services that providers can register themselves into. This catalogue is targeted at large cloud providers that are evaluated in terms of legal and privacy topics based on criteria defined by GEANT. There is no charge to be registered in this marketplace and relationships are done directly between resource provider and those seeking services.

7.1.3 UberCloud Marketplace

The UberCloud Marketplace is unique in that it comes from the perspective of the researcher interested in solving specific problems. It offers a high quality set of “experiments” describing how to solve different computational problems that researchers may be interested in. These experiments often map to the software providers in their catalogue (e.g. ANSYS, OpenFOAM) which can use various Infrastructure as a Service (IaaS) resource providers also listed in their catalogue. The catalogue also lists expertise and training that may be of use. The UberCloud uses a brokerage model for use of these services and benefits from a portion of the fees paid for the services discovered via the UberCloud marketplace.

7.1.4 Science Exchange

Science Exchange is unique in that it offers any type of service (DNA sequencing, data storage, computational analysis, etc.). It has over 6000 offerings listed and works via a brokerage model.

7.1.5 Internet2 Net+

Internet2 Net+ works in a similar manner as the GEANT Cloud Catalogue in that it aggregates different cloud offerings that meet a set of standards. In addition in most cases special pricing and conditions are defined for participants of Internet2. These offerings are primarily targeted at the

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institutional or department level. Inquiries about the cloud services a funnelled through Internet2 and then to the partner like a broker but Internet2 does not take a portion of the fees.

7.1.6 Helix Nebula Marketplace

The Helix Nebula Marketplace is focused on delivering SaaS and IaaS services to academic organizations. These services are tightly integrated with SlipStream from SixSq and agreements are primarily done at the organizational level to use these services.

7.2 Conclusions

It can be seen by this examination they there is a heavy bias towards the brokerage model and the focus is solely on the pay for usage concept. This leaves out a large segment of resources that are offered for free.

	brokerage	free services	IT resources	general science resources	local lab resources
FI-WARE Marketplace	X	X	X		
GEANT Cloud Catalogue	X	X	X		
UberCloud Marketplace	X		X		
Science Exchange	X			X	
Internet2 Net+	X		X		

Comparison of Related Activities

Based on this it can be observed that there is a gap for provisioning of local lab resources and general science resources. As well it can be seen that the current activities focus heavily on IT resources.

8 Operating model

8.1 Marketplace Concept

How a marketplace functions in a legal, policy and business framework is an incredibly complex topic within a single country, let alone across national borders. There are two perspectives on this, that of the marketplace provider and that of a resource provider.

8.1.1 Marketplace Concept

In many instances a marketplace provider will act as a broker. However, as the types of resource usage fee structures are extremely diverse, any kind of broker model is challenging. Not to mention potential legal implications and policy implications. For this it is opted to go with offering a “marketplace as a service” concept and not use a broker model, where individual marketplace providers can determine the business model that fits best. The establishing marketplaces will also need to establish their own policies and terms of use.

8.1.2 Resource Providers

With resource providers offering a high variety of resources, it is not possible to define restrictions on how resource providers operate. Instead tools can be put into place to allow the resource providers to respect the legal, policy, and business processes applicable to them. In essence the resource providers will be self-governing, no different than what may be found from marketplaces such as eBay and Booking.com, or web hosting companies. If a resource provider is demonstrated to doing something other than offering services in the support of research or breaking laws, then they forfeit the right to use the marketplace platform.

8.2 Business model

8.2.1 Introduction

In order to be successful and ensure long term sustainability the marketplace platform must develop an appropriate business model, so a strategy to develop and periodically review the business model needs to be defined and methods for doing so will be outlined below for future reference. This will be valuable in establishing the platform and should be examined periodically as the platform develops.

8.2.2 Analysis

8.2.2.1 Business Model Canvas Analysis

Business Model Canvas is one of the best-known tools to develop and describe business models. It can help to elucidate and express a business model in order to create a shared understanding and

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identify areas for improvement. Canvas describes business models through nine basic building blocks that show the logic of how an enterprise functions in a simple, relevant, and intuitively understandable way while not oversimplifying the complexities. Canvas covers the four main areas of a business: customers, offer, infrastructure, and financial viability. In the following sections are short descriptions of a possible marketplace platform for each building block provided.¹¹

KEY PARTNERS <ul style="list-style-type: none"> Academic institutes Academic collaborations Consortium members 	KEY ACTIVITIES <ul style="list-style-type: none"> Marketplace platform management (Platform that enables users to share, discover and book research resources) 	VALUE PROPOSITION <ul style="list-style-type: none"> Providing a proven, reliable and feature rich management tool for any research resources. Enables and optimizes resource sharing in and between organizations Free tool Direction of tool can be driven by participating in consortium Support for consortium members 	CUSTOMER RELATIONSHIPS <ul style="list-style-type: none"> Self-service platform Consortium members 	CUSTOMER SEGMENTS <ul style="list-style-type: none"> Researchers and research labs Organizations and institutes Consortium members
	KEY RESOURCES <ul style="list-style-type: none"> Marketplace platform 		CHANNELS <ul style="list-style-type: none"> Web platform Consortium 	
COST STRUCTURE <ul style="list-style-type: none"> Open IRIS platform management and development User support 			REVENUE STREAMS <ul style="list-style-type: none"> Grants Partner contributions Consortium subscription 	

Canvas Business Model for the Marketplace Platform

Customer Segments: The marketplace platform is targeted at the niche segment of research resource providers and users of these resources in academia or industry. These can be as small as an individual lab to a resource provider serving multiple institutions across national boundaries.

Value Proposition: The platform will be free and offer resource providers all the tools they need to manage their resources. The basic functionality will be available to all resource providers (resource listing, access management), and additional features can be turned on as needed (e.g. billing, invoicing, resource restrictions). Normally similar commercial tools can be costly, so there is tremendous value to have a free tool and a low barrier for entry.

Channels: The concept is to work with resource providers to integrate their resources. Then it is assumed that other resource providers in proximity will adopt the solution. It will also be promoted at meetings relevant to different resource providers segment (e.g. microscopy, core technology facilities).

¹¹ Alexander Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers (John Wiley & Sons, Inc., 2010), p. 14

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Customer Relationship: The administrator of the system will work directly with organizations, communities, and resource providers. The consumers will have a direct relationship with the resource providers.

Revenue Streams: The usage of the tool will be free. The primary revenue stream is currently from grants with contributions from partners.

Key Resources: The key resource is the deep understanding of the requirements of the resource providers, and tailoring a solution to meet their needs.

Key Activities: The most important activity will be on problem solving for the short term (2-3 years), so as to focus on developing a solution that meets the diverse needs of resource providers and satisfying end user's needs.

Key Partnerships: The key partnership will be providers that will promote the solution to other resource providers. In addition relationships with resource provider communities will be vital to promote the solution (e.g. EGI, Euro-Bioimaging)

Cost Structure: The business model will be cost driven in order to have enough funding to continue to develop the solution. This is currently funded by grants but will need to transition to a sustainable source of funding.

Through comparing several different related business models from existing businesses (Red Hat, Booking.com, SB Grid, Google) we learned that all business models are very different but all of them are successful at what they do and the results can be seen in Appendix II. We were not able to find one solution that would cover all our needs but we were able to learn key elements from each business, which can be used to generate the new business model.

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8.2.2.2 SWOT Analysis

The SWOT assessment provides a snapshot of where the business is now (strengths and weaknesses) and shows future business possibilities (opportunities and threats). The SWOT analysis is a significant part of the process designing new business model options towards which the enterprise then eventually can evolve.¹²

<p style="text-align: center;">Strengths</p> Value propositions Customer relationship Key partners Cost structure Key resources Key activities	<p style="text-align: center;">Weaknesses</p> Customer segments Channels Revenue streams Grant Dependent
<p style="text-align: center;">Opportunities</p> Channels need be expanded New value propositions possible New revenue streams can be created	<p style="text-align: center;">Threats</p> Very dependent on key partners Revenue streams are disappearing Dependent on one revenue stream

SWOT Analysis Output

In terms of the detailed SWOT analysis performed we identified several weaknesses and threats mainly for the customer segments, channels and revenue streams. But the analysis also provides opportunities and strengths that help to overcome those problems. For example, the revenue streams are dependent on grants but there may be opportunities to create new revenue streams via a consortium based business model.

8.2.2.3 Blue Ocean Strategy Method

The Blue Ocean Strategy method introduced by Kim and Mauborgne¹³ is a perfect extension for the Business Model Canvas. In conjunction they provide a powerful framework for questioning established business models and creating new, more competitive models. The Blue Ocean Strategy is a method for questioning value propositions and business models. The Business Model Canvas provides a visual “big picture” that helps us understand how changing one part of a business model impacts other parts. The Blue Ocean Strategy is about creating completely new industries through fundamental differentiation as opposed to competing in existing industries by adapting

¹² Alexander Osterwalder and Yves Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (John Wiley & Sons, Inc., 2010), p. 224

¹³ Chan Kim and Renée Mauborgne, *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant* (Harvard Business School Press, 2005)

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established models. The idea is to create new, uncontested market space through value innovation instead of outdoing competitors in terms of traditional performance metrics.¹⁴

To achieve value innovation an analytical tool with a four actions framework emerged:

1. **Eliminate** factors that the industry takes for granted
2. **Reduce** factors below the industry standard.
3. **Raise** above the industry standard.
4. **Create** factors that the industry never has offered¹⁵

We asked the four actions framework questions (eliminate, create, reduce, raise) about each business model building blocks and looked at the implications for the other parts of the business model.

We came to the result that we could eliminate or transform grant participants and partners into consortium members. At the same time we have to create new value propositions to make it attractive for customers to become consortium members by making them a part of the project and therefore can take influence on the platform development. Furthermore they can take advantage of support of the platform. To make the platform sustainable, a new revenue stream from consortium members could be generated.

8.2.3 Conclusions of the Business Design Analysis

The value proposition of receiving something free of charge has always been very attractive and the freemium approach is an expectation of most users of web-based services. The demand generated at a price of zero is many times higher than the demand generated at any other price point. The questions are how does an organization that offers free products or services generate revenues, when they offer them for free. Part of the answer is that the costs of offering certain services and products, such as online web and storage services, have fallen dramatically.¹⁶

There are several known patterns that make integrating free products and services a viable business model option. Each pattern has its own characteristics but they all have one thing in common: at least one customer segment continuously benefits from the free-of charge offer. In this section we look at two of these patterns: free offer based on multi-sided platforms and free basic services with optional premium services (the so-called freemium model, which provides basic services free of charge and premium services for a fee).¹⁷

¹⁴ Alexander Osterwalder and Yves Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (John Wiley & Sons, Inc., 2010), p. 226

¹⁵ *Ibid.*, p227

¹⁶ *Ibid.*, p. 90

¹⁷ *Ibid.*, p. 90

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8.2.3.1 *Multi-sided Platform Model*

Multi-sided platforms are platforms that bring together two or more distinct but interdependent groups of customers. The platform must attract and serve all groups simultaneously in order to create value as intermediary by connecting these groups. Credit cards, for example, link merchants with cardholders; newspapers link readers and advertisers; video gaming consoles link game developers with players. Multi-sided platforms often face a “chicken and egg” dilemma because the platform’s value for a particular user group depends substantially on the number of users on the platform’s “other sides.” One way to solve this problem is to lure one segment to the platform with an inexpensive or free value proposition in order to subsequently attract users of the platform’s “other side.” The key elements for a multi-sided platform are to understand which side to subsidize and how to price correctly to attract customers.¹⁸

8.2.3.2 *Freemium Model*

Freemium stands for business models, mainly web-based, that blend free basic services with paid premium services. The freemium model is characterized by a large user base benefiting from a free, no-strings-attached offer and most of these users never become paying customers. Usually less than 10 percent of all users subscribe to the paid premium services. The premium users subsidize the free users. This is possible because serving additional free users only generates a small marginal cost. The key elements for a freemium model are the average cost of serving a free user, and the rates at which free users convert to premium customers.¹⁹

8.3 Summary

It was determined that a potential business model is to offer the marketplace as a service platform entirely for free to academic and commercial providers, and establish a consortium model, where participants in the consortium benefit from support and can drive the direction of the development. This also helps overcome the issue of certain non-fee based services (e.g. national resources, consortium resources, local resources) would not be compatible with a brokerage or commercial marketplace solution. A consortium model with institutions as members can fund the sustainability of the marketplace as service model. This will overcome the negative side of a broker model (leakage of customers, conflict of interest, legal and policy issues, etc.).

¹⁸ Ibid., p. 78

¹⁹ Ibid., p. 96

9 Recommendations

The platform planned will enable sharing and discovering of research resources, which in essence becomes a marketplace of marketplaces of free and fee based research resources using a cloud model and adaptation of common e-marketplace models for cloud services.

9.1 Review of Original Objectives

9.1.1 One-Shop-Stop Concept

The original goal of this activity is the establishment of an EGI marketplace of research related services for science, ideally applying the one-shop-stop concept. In order to develop a one-shop-stop concept, EGI must develop a solution that allows resource providers to register and provide any type of relevant research resource within the marketplace without any barrier of entry. Then with tools within the system the resource providers can control visibility and access to these resources to create distinct views on their resources. These may be local to their organization or from a community. In essence a marketplace as a service model will need to be developed for resource providers, and for the user a personalized environment is provided to help discover and use these resources.

In academia research resources are often provided free (e.g. internal facilities, national resources) or based on project funding. In some cases resources are offered internally or externally for a charge, most times with a different cost structures for each. Therefore using a brokerage model where a portion of the fees is used to fund a marketplace infrastructure is not practical. In addition the goal would be to have as many participants in the marketplace as possible, and the expectation from users today is that an Internet based tool is offered free of charge. Different approaches can be used to allow the tool to be offered for free and with no brokerage fee, but in the end the approach of a consortium funded tool was found to be the most appropriate. As there will be many different business models for resource providers, individual resource providers must be able to select which one they use or even use multiple types (e.g. free to a particular research community and pay for use to researchers outside a community). The marketplace should put no constraints on the business models used by resource providers.

9.1.2 Legal, Policy and Business Framework for a Marketplace

This activity involved the analysis and development of a legal, policy and business framework for a marketplace. The legal, policy and business framework is an incredibly complex topic within a single country, let alone across country borders. In this context it is best for the marketplace as a service platform to not set any restrictions in terms of policy, but let individual resource providers be responsible to comply to legal requirements and policies that may apply to them. This is already the case for services such as Booking.com, eBay, etc. However, the marketplace solution

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will need to provide tools to facilitate resource provider's compliance to applicable policies and laws. This can be done by offering tools for handling requests, controlling access, controlling visibility of information, accepting usage guidelines before using resources, accounting, and billing functionality as needed for different cases. These functionalities can be developed with individual resource providers, and generalized so that other resource providers can take benefit from the solutions that are implemented.

9.1.3 Allocation of Capacity to Research Communities in Collaborations

In discussion with various communities the activity examined scenarios for allocating capacity to research communities in collaborations with pilot user communities (user-driven scenario development). In doing so the activity has gathered a set of requirements that will be provided as input into the development of the solution. These mostly centred around visibility and access control, allowing for internal and external usage of research resources.

9.1.4 Incentive Mechanisms for Resource Centres to Provide Capacity

All research organizations have resources they share or can share between research groups, as well as national and international research resources that are shared between institutions. However, researchers may not be aware of these resources or they are not shared more widely because the tools do not exist to easily share them. In order to facilitate and incentivize resource providers to share resources, the marketplace platform must be able to easily list research resources and provide tools to resource providers to facilitate providing resources. The tools must be optional so a resource provider can select those that are applicable for their use case. These tools can be such things as: visibility restrictions, access restrictions, custom portals, statistics reporting, usage restrictions, billing, etc. These tools must be flexible and simple enough for an individual lab to share resources internally and powerful enough for large pay for use resource providers to provide resources for a fee.

9.1.5 Analysis of Revenue Streams for Resource Providers

Each resource provider will have different target audiences. However, there are many different approaches in how they generate a revenue stream to fund their activities. This is as diverse as being able to demonstrate the impact of the resource with citations, demonstrate usage and demand with statistics of usage, co-funding of research grants, and fully funded by paying for usage. The marketplace tool will need to support all these models and help different resource providers implement best practices to help them sustain or increase revenue streams. These tools should allow for things such as PCP (pre-commercial procurement), PPI (public procurement of innovation), direct charging to users, and free service at the point of delivery.

9.1.6 Integration with Other Marketplaces

The marketplace tool will be primarily focused on small to medium size resource infrastructures, whereas most other marketplaces are focused on large resource providers. However, it is of

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interest to allow users of the marketplace to discover resources from other marketplaces, and in some cases it may be of interest to have resources within the marketplace solution exposed to other marketplaces. However, as in most cases as demonstrated in the analysis of related projects these generally target large resource providers, so there is not a high degree of overlap. Therefore instead of focusing initially on this integration the marketplace to other marketplaces this will be done on an opportunity basis based on requests from resource providers or users of the system, or potential collaborations with other marketplaces. This can be done either by importing resource listings from other marketplaces (e.g. GEANT cloud) or providing tools to integration with others (e.g. Helix Nebula).

9.1.7 Outputs of the Pay-for-Use Activity

The EGI Pay-for-Use project has demonstrated the heterogeneity and complexity of offering of research resources for a fee (e.g. sharing of nationally funded infrastructure to international participants). Resource providers have defined policies for their target audience, and in some cases they can extend to offer underutilized resources to people outside of that audience. Since the policies to do so are complex, it is decided that each resource provider will need to be able to define their audience and policies. The resource providers in the Pay-for-Use case will be invited to register their resources in the marketplace solution.

9.2 Conclusions

The characteristics of the marketplace solution:

- The marketplace should be designed as a “marketplace as a service” with a robust service model. This is based on the requirements from surveys and interviews that require both public, private, and branded portals. In this way labs, organizations, national and international academic resource provider, research consortiums, and commercial entities can use it to advertise services internally and to others as desired. This can be done by allowing for portals to be created where resources can visible for select set of people (e.g. organizational level, consortium, nationally), while allowing some of these resources to be exposed to other large portals (e.g. regional business development portals).
- It will need to be able to support simple listing with redirects to other services, or as sophisticated as providing tools for helping manage the resources offered (e.g. usage restrictions, usage metrics, invoicing).
- The tool will need to offer abilities to federate with local, national, international, and social authentication systems. This should also include authentication systems of commercial entities.
- The ability to restrict visibility of the resources by user, group, organization, department, project and community (e.g. consortiums).
- There should be no barrier of entry into the system for resource providers. That is anyone can list any research relevant resource with very few restrictions (e.g. resource providers

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must comply too license restrictions of resource they provide, they must obey applicable laws and organizational policies).

- Any users must be able to register and login into the system in order to view resources appropriate for them.
- The system must be completely free for user, including use by commercial providers.
- The sustainability of the marketplace platform can be funded by a consortium model, with members providing funding and direction for the development of the system.

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Appendix I. Requirements from marketplace user stories

Number	Requirement	
01	Service Management	
01	01	Service Provider
		Provider registration: Users can register a resource provider.
	01	<p>Service registration: The service provider is able to register a service in the service catalogue and can specify detailed information and display options for his service including:</p> <ul style="list-style-type: none"> • Service name • Service description • Service instructions • Service visibility • Assign pricing • Usage policy • Picture • Highlight service • Hide a service • Check order status
	02	<p>Usage policies and SLAs: The service provider is able to manage service level agreements and usage policies for his services:</p> <ul style="list-style-type: none"> • Create service level agreements • Modify service level agreements • Assign service level agreements to services • Modify terms of usage and policies
	03	<p>Availability: The service provider can define a time window for when his services are unavailable:</p> <ul style="list-style-type: none"> • Define unavailability (Time and Day, e.g. 2015-07-03 8:00 AM to 5:00 PM) • Inform users
	04	<p>Reporting: The service provider is able to view usage reports for users, groups and communities that are using his service. The usage report shows data about:</p> <ul style="list-style-type: none"> • Number of users • Services used • Service consumption

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	05	Tickets: The service provider is able to manage his tickets: <ul style="list-style-type: none"> • reply to tickets • close tickets • delete tickets
02	User	
	01	Tickets: The user is able to open support tickets.
	02	Publications: Claim publications that were possible as a result of services (e.g. backend integrated with OpenAIRE, data fed into OpenAIRE)
	03	List: The user can list all services they have access to see details (pricing, how to access, SLAs, associated information, creation date, last update, etc.): <ul style="list-style-type: none"> • Services • Applications • Appliances
	04	Search: The user is able to search and filter for resources on the basis of: <ul style="list-style-type: none"> • characteristics • search term • virtual organization
	04	Status: The user is able to view the status of services: <ul style="list-style-type: none"> • Availability (available, unavailable, service outage, maintenance, etc.)
	06	Policies: Negotiate the SLA through a broker or accept the pre-defined SLA associated to the service
	07	Policies: The user can accept or decline usage policies.
	08	Contact: The user is able to contact the service provider via messages.
	09	Rating: The user is able to review and rate services and service providers: <ul style="list-style-type: none"> • rating and commenting system
	10	Usage: The user is able to view his own usage information including: <ul style="list-style-type: none"> • Services used
	11	Documentation: access documentation (knowledge base)
	12	Finance: The user is able to review incurred expenses and pay for a service.
	13	Resource access: request authorization to access one or more services

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	03	Directory Manager (organizations, groups, departments, projects, communities)
	01	<p>Reporting: The directory manager is able to view reports for:</p> <ul style="list-style-type: none"> • Resources available to his virtual organization / users • Resources used by his virtual organization / users • Resources booked by his virtual organization / users • Number of users • Services used • Consult consumption / usage
	04	Administrator
	01	<p>Provider management: The administrators is able to manage resource provider requests:</p> <ul style="list-style-type: none"> • Accept resource provider request • Decline resource provider request (with reason) • Disable a provider (with reason)
02		Access Management
	01	Service Provider
	01	<p>Service access request: The service provider can manage service access requests for an individual user, group or community:</p> <ul style="list-style-type: none"> • Allow access • Decline access (with reason)
	02	<p>Directory management: The service provider can manage all users, groups and communities that have access to his service:</p> <ul style="list-style-type: none"> • List of all members • Remove members • Invite members
	03	<p>Usage limits: The service provider can manage usage quotas for his resources and assign them to users, groups and communities:</p> <ul style="list-style-type: none"> • Define quota (e.g. time) • Assign quota
	04	<p>Service access: The service provider is able to publish his services in the service catalogue and can manage to whom his services are visible as well as hide services:</p> <ul style="list-style-type: none"> • Users • Groups • Virtual organizations • Everyone

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	02	Directory Manager (organizations, groups, departments, projects, communities)
	01	<p>Directory requests: A directory manager can manage membership requests for users:</p> <ul style="list-style-type: none"> • Accept membership request • Decline membership request (with reason)
	02	<p>Directory management: The directory manager is able to manage the memberships:</p> <ul style="list-style-type: none"> • List of all members • Remove members • Invite members • Promote member to administrator
	03	User
	01	Provider registration: Request Users can request to become a resource provider.
	02	Directory search: search for suitable VO
	03	<p>Directory requests: The user is able to request access to:</p> <ul style="list-style-type: none"> • Services • Virtual Organizations • Groups
	04	Administrator
	01	Directory administration: Able to manage all aspects of the directory to support directory managers and users.

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Appendix II. Comparison of Business Models

Subject		EGI Marketplace	Google	Booking.com	Red Hat	SBGrid
Business Model Type		multi-sided platform	multi-sided platform	multi-sided platform	Freemium	Freemium
Customer Segments	Mass market	No	No	No	No	No
	Niche market	Yes	No	No	No	Yes
	Segmented	No	No	No	Yes	No
	Diversified	No	No	No	No	No
	Multi-sided-platform	Yes	Yes	Yes	No	No
Value Propositions	Newness	Yes	Yes	Yes	Yes	No
	Performance	No	Yes	No	Yes	Yes
	Customization	Yes	No	No	Yes	Yes
	Getting the job done	Yes	Yes	Yes	No	Yes
	Design	No	No	No	No	No
	Brand/Status	No	Yes	Yes	Yes	No
	Price	Yes	Yes	Yes	Yes	Yes
	Cost reduction	Yes	No	Yes	Yes	Yes
	Risk reduction	Yes	No	No	Yes	Yes
	Accessibility	Yes	Yes	Yes	No	Yes
	Convenience/Usability	Yes	Yes	Yes	Yes	Yes
Channels	Sales force	No	No	No	Yes	No
	Web sales	No	Yes	Yes	Yes	Yes
	Own stores	No	No	No	No	No
	Partner stores	No	No	No	No	No
	Wholesaler	No	No	No	No	No
Customer Relationship	Personal assistance	Yes	No	No	Yes	Yes
	Dedicated personal assistance	No	No	No	Yes	Yes
	Self-service	Yes	Yes	Yes	Yes	Yes
	Automated-services	Yes	Yes	Yes	Yes	Yes
	Communities	Yes	No	No	Yes	Yes
	Co-creation	No	No	No	Yes	Yes
Revenue Streams	Asset sale	No	No	No	No	No
	Usage fee	No	No	No	No	No
	Subscription fees	No	No	No	Yes	Yes
	Lending/Renting/Leasing	No	No	Yes	No	No

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	Licensing	No	No	No	No	No
	Brokerage fees	No	No	Yes	No	No
	Advertising	No	Yes	No	No	No
	Grants and consortium contributions	Yes	No	No	No	Yes
Key Resources	Physical	Yes	Yes	Yes	No	Yes
	Intellectual	Yes	Yes	Yes	Yes	Yes
	Human	Yes	Yes	Yes	Yes	Yes
	Financial	No	No	No	No	No
Key Activities	Production	No	No	No	Yes	No
	Problem solving	Yes	Yes	Yes	No	Yes
	Platform/Network	Yes	Yes	Yes	No	Yes
Key Partnerships	Strategic alliances between non-competitors	Yes	Yes	Yes	Yes	Yes
	Coopetition: strategic partnerships between competitors	No	Yes	Yes	Yes	Yes
	Joint ventures to develop new businesses	No	Yes	No	Yes	No
	Buyer-supplier relationships to assure reliable supplies	No	No	No	No	No
Cost Structure	Cost driven	Yes	No	Yes	Yes	Yes
	Value driven	No	Yes	No	No	No
Epicentres	Offer-driven	Yes	Yes	Yes	Yes	Yes
	Customer-driven	Yes	Yes	Yes	Yes	Yes
	Finance-driven	No	No	No	No	No